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PRINCIPLES OF TAXATION.

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II.—THE PLACE OF TAXATION IN LITERATURE AND HISTORY.
PART III.

TAXATION IN THE MEDIÆVAL PERIOD.—With the termination of the Roman Empire of the West, which is regarded as having taken place A. D. 476, when Odoacer, chief of the Germanic tribe Heruli, captured the city and assumed the title of King of Italy, a new and great element was introduced into European life, through the intermingling of the northern barbarians with the civilized, Christianized, and degraded Romans of the south. The following period, for at least five hundred years, was characterized, to an extent never before surpassed in the world's history, by bloodshed, license, licentiousness, turmoil, robbery, and woe. Franks, Burgundians, Visigoths, Saxons, Slavs, Huns, Danes, and Normans crowded upon and warred with each other. From such a period, when neither the agriculturist nor the artificer could control to any great extent the fruits of his labor, and when the merchant "stole along the hedges, shrank from the eye of the passer, and stepped into rivers cautiously, seeking a ford, lest the man at the bridge should rob him," but little in the way of economic or fiscal principle could be deduced. In short, a new society, the foundation and precursor of what now exists, was in the process of evolution; but in order that evolution might commence, it would seem to have been necessary that all the elements of the old should have been completely dissolved, in order that its atoms might move freely—a condition like that to which the chemist is compelled to bring earthy mineral substances in order to effect their purification and crystallization.

The period when the molecules of society seem to have begun to combine anew, is generally assigned by historians to the eleventh century, when feudalism had become systematized into something analogous to general government, and the power of the Church was especially manifesting itself; and was recognized to such an extent that it was able to establish throughout nearly all Europe a period known as "God's Truce," when warfare, plunder, and bloodshed were forbidden from sunset on Wednesday to sunrise on Monday; and "during the Christmas holy days and Lent no new defenses were to be erected, nor old ones repaired. But this was not all. The provisions made for the protection of the laborer and for the produce of labor were far more characteristic of the dawning of a new era. Peasants in hostile territories were not to be injured or confined; the tools of agriculture, the hay and the grain stacks and the cattle, were all taken under the protection of the Church; and if seized, it must be for use and not for destruction. He that violated this truce was placed under censure of ecclesiastical power." From this period, therefore, it is only practicable to take up anew the thread of history, and attempt to resume the relation of some of the most instructive incidents that have since characterized the attempts of governments to defray their expenditures by levies upon the persons and property of their subjects or citizens. Preliminary, however, to so doing, the following historical facts may properly find a place.

How the Druids collected Revenue.—An annual payment in the nature of a tax was exacted by the ancient Druids from every family for the benefit of the priests of the temple in the district in which the family lived. The families were obliged, under penalty of an ecclesiastical curse, to extinguish their fires on the last evening of October, and attend at the temple with a prescribed annual payment. This being made, they were entitled to receive, on the first day of November, some of the sacred fire from the altar, to rekindle the fires of their houses; and their neighbors were also forbidden, under a similar penalty, in any way to assist them. The result was, that delinquent taxpayers found themselves not only interdicted from the society of their fellow-men and from justice, the usual sequence of ecclesiastical excommunication, but also from the use of fire during the approaching winter. This expedient for collecting a revenue was referred to by the British Chancellor of the Exchequer, in a speech in Parliament in 1871, in connection with a proposal to tax matches; and the motto, *Ex luce lucellum*, was proposed to be inscribed on match boxes in case the tax was enacted.*

* Toland's History of the Druids, quoted by Dowell, in History of Taxation in England.

MEDIÆVAL SYSTEM OF LAND TENURE.—Among the nations that succeeded to the sovereignty of Rome, the title and ownership of land was regarded, as it is to-day in China, and in England and other European countries, as inhering primarily to the sovereign or chief of the state; and when partitioned among his nobles or chiefs, was held by them as it was termed on "tenure;" that is, on condition of performing certain services—mainly military, or the payment of a tribute—in the nature of rent. These conditions were ratified by oath; and the chiefs could only sublet, to their serfs or inferiors, on terms consistent with their own tenure.

Large domains were also set apart for the exclusive use of the sovereign *—both in his public and private capacity—the state and the sovereign being one and the same; and from the revenues thus accruing, and various fees and feudal incidents, the monarch, or feudal lord, was expected to defray all the expenses of the state, both public and private. Thus, the annual revenue of William the Conqueror is estimated to have been £400,000; which, taking into consideration that the *pound* at that time contained three times the weight of silver that it now does, and that silver had a comparatively great purchasing power, must have been equivalent to at least four or five millions of present money; and of the public expenditures of these ages it is important to note that there were very few that represented the bulk of the expenditures of modern governments.

Thus, for example, education was mainly confined to the clergy and the Church; and was efficiently supported by the produce of their own estates, or by tithes levied on the estates of others. There were few roads, and the labor of the serfs or peasants for a few days, before or after harvest, sufficed to keep in passable condition such as were needed to meet the demands of a very limited intercourse and commerce between different sections of the country. The administration of justice was held to be the perquisite of the lords or chiefs holding their estates direct from the crown, and, in place of being an expense, became through abuse and corruption a source of emolument. The standing army, which more than any one agency has tended to the impoverishment of modern Europe, could hardly be said to have then existed; the tenants in chief of the crown supporting the sovereign whenever

* The royal demesne (right of ownership) under the Norman kings was at one time of vast extent, comprising, according to Domesday Book, no less than fourteen hundred and twenty-two manors or lordships, besides farms and lands. It was divided into (1) forest; (2) land held by rural tenants; (3) royal cities, burghs, and towns. The first formed the king's hunting ground, and afforded supplies of venison, etc., for the royal table; the second supplied the king's table in other respects; the third was mainly the source of contributions for the discharge of the king's debts.

he took the field with a body of retainers, armed and maintained in a large degree at their own expense. The necessity of taxes in the ordinary sense was, therefore, by these conditions entirely superseded; and if at any time there was a deficiency of revenue from the crown estates and fees, other sources of revenue were resorted to in preference to anything that could by any possibility be regarded as taxes.

Numerous old-time writers of authority—Montesquieu among the number—might be cited in support of what was then regarded as an eminently sound principle, that governments ought to be supported from revenues derived from the public domains, and that taxation should be resorted to as rarely as possible; because, as one of them expressed it, "one enters into civil society to protect one's property, and not to have it taken away from him." It is also interesting to note in this connection the tendency at the present time to go back to this old doctrine, and for states and municipalities to derive their revenues from other sources than taxation—as from the granting of franchises for railways, telegraphs, telephones, gas supply, lotteries, etc., on condition of participation in profits on gross receipts. Thus, the present net profit on the German state railways is understood to pay the interest on the public debt of Germany. Nearly all the Continental states of Europe derive a considerable portion of their needed revenues from the profits of their domains and forests—Prussia to the extent of about $11,000,000 per annum; France, $5,500,000; Hungary, $3,000,000, and the like. The city of Paris derives about twenty per cent of its revenue from participation in the operation of franchises and income from productive property. In Berlin eighteen per cent. of all the municipal expenses are reported as derived from the public gas supply. In Illinois the State expenses are mainly defrayed from the State's share of the annual profits of the Illinois Central Railroad; and in Louisiana also, the State formerly and recently has participated in the profits of an authorized State lottery. If the ideas of Mr. Henry George, of a single tax on land, should prevail, and if such a tax does not diffuse itself, then the entire land of the country would in the course of time become the property of the state exclusively; and the old principle that a state should be supported from its own landed resources and property would be reasserted and established.

The following were some of the sources of revenue, other than what were assumed to be *taxes*, that were resorted to in mediæval times to make good any deficiency of income which the crown, as representing the state, derived from its special properties and privileges; and a reference to which is important, by reason of the flood of light they shed upon the concurrent social condition of the masses, and the utter disregard of their rulers

of anything akin to justice in their administration of government. One of the most notable of these sources was the Jews, who during the middle ages had no rights of citizenship in Christianized Europe, and were held, in respect to their persons, goods, wives and children, at the absolute disposal of the chief of the state, to be taxed and despoiled by him at his pleasure. This utilization of the Jews as sources of revenue was far more thoroughly and systematically carried out in England than in any other country. "They were, in fact, the private property of the king; living instruments of his revenue; carefully protected by his government, unless in cases where exceptional necessity on his part or obstinacy on theirs made it expedient to bear upon them with unusual weight;* not serfs bound to the soil, but slaves of the highest value, to whom to allow free action in the acquisition of wealth was the needful condition of reaping the fruit of their labor. There is a writ of Henry III in which, in payment of a debt to his brother Richard of Cornwall, he assigns and makes over to him "all my Jews of England." †

William Rufus (William II of England) actually forbade the conversion of a Jew to the Christian faith. "It was a poor exchange," he said, "that would rid him of a valuable property and give him only a subject."

Under Edward I of England the Jews were plundered and amerced to such an extent that it is estimated that they paid over one tenth of the entire revenue of the crown.

An explanation of the apparently anomalous circumstance that the Jews, although deprived of all civil rights and debarred from following most occupations, were able to be plundered to such an extent, is found in the fact that they were the "royal usurers," and under the king's protection spoliated through extreme usurious interest the Norman barons, who were always in want of money, and were not the men to readily tolerate "benevolences," or any other form of direct taxation for supplying the king with money necessary for the support of the government. So that when the king plundered the Jewish money lenders, he in reality obtained indirectly the money he needed from his barons, with far less odium and more profit than if he had proceeded against them directly.

Very curiously, this mediæval idea of regarding the Jews as a

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* Such a case of urgent necessity or inexcusable obstinacy must have been assumed as existing by King John, of whom it is related, that on one occasion he demanded the sum of ten thousand marks (thirty thousand dollars) of a Jew at Bristol, and on his refusal to pay, ordered one of his teeth to be drawn every day until he should comply. The Jew, it is chronicled, lost seven teeth and then paid the sum required of him.

† Oxford Essays. By J. Bridges, Fellow of Oriel.

permanent, legitimate, and desirable source of revenue for the state, continued to find favor in England as recently as the reign of William and Mary, or in 1689; when, money being needed to prosecute the war with France, it was seriously proposed to exact, under the semblance of taxation, a hundred thousand pounds from the Jews, and the proposition was at first favorably received by the House of Commons. "The Jews, however, presented a petition to Parliament in which they declared that they could not afford to pay such a sum, and that they would rather leave the kingdom than stay there and be ruined; and after some discussion the Jew tax was abandoned." For, as Macaulay expresses it, "Enlightened politicians could not but perceive that special taxation, laid on a small class which happens to be rich, unpopular, and defenseless, is really confiscation, and must ultimately impoverish rather than enrich the state."*

It is hardly necessary to point out that ill treatment of the Jews has not been confined to English rulers and people. In every country or state of Christendom they have been subjected to arbitrary, unequal, and unjust exactions, deprived of ordinary political privileges, and driven as homeless wanderers from cities which their presence and their purses had enriched. And that this race antagonism continues to be perpetuated to the present day, is demonstrated by their recent and virtual expulsion from Russia; and even in the United States (where it might least be expected) by a vulgar and brutal denunciation by a member of the Federal Senate of the chief executive officials of the country, for the assumed reason that they had entered into a fiscal correspondence with an Englishman of Jewish descent, whom England had admitted to a seat in her Parliament, and whose whole life had been characterized by strict integrity, courtesy to all, and large benevolence.

Another extraordinary source of revenue to the crown in feudal times, was the forfeiture of lands and estates for offenses; and of the immense sums thus obtained, some idea may be formed from the circumstance, that up to the time of Elizabeth it has been estimated that nearly all the land in England had at some time fallen to the crown under the law of forfeitures. Other devices for the raising of revenue which were very productive, were fines for the alienation (legal conveyance) of land, which were exacted oftentimes to the extent of one third of their yearly value, whenever the tenant found it necessary to make over his land to another; and from the sale of titles, which even as late as 1626, under Charles I, afforded considerable revenues. The right of marriage was subject (at least in the case of nobles

* Macaulay's History of England, vol iii, chap. xv.

and gentry) to the consent of the crown; and in some instances large sums were paid for the privilege; Simon de Montfort paying Henry III a sum, equivalent to five hundred thousand dollars at present, for permission to control the marriage of the heir of Gilbert d'Unfrankville. Mr. Dowell, in his History of Taxation in England, quotes the following as among one of the "fiscal curiosities" to be found on the Rolls of the Exchequer during the early Norman period: "Ralph Bardolph fines in five marks for leave to rise from his infirmity. The Bishop of Winchester owes a tonnell of good wine for not reminding the king (John) about a girdle for the Countess of Abunarle; and Robert de Vaux fines in five of the best palfreys that the same king would hold his tongue about the wife of Henry Pinel."

Another branch of the ancient revenues of the English crown worthy of special notice from its singular recognition within a comparatively recent period, was the right to "royal fish," meaning thereby the whale and the sturgeon, when the same were either cast ashore or caught near the coast; and which were originally acquired by the crown on the assumption that the sovereign guarded and protected the seas from pirates and robbers. This perquisite had so long been in abeyance that its sanction by law was hardly recognized in 1850, when the Duke of Wellington, as Lord Warden of the Cinque Ports, claimed and exacted the price—fifty pounds—of the carcass of a whale brought ashore and sold by certain boatmen on the coast of Kent. A point of contention was made by the boatmen, that since the law was enacted, natural science had proved that the whale was not a fish; but the duke insisted upon his right under the letter of the law of compact with his office of warden—i. e., to protect the seas—as representative of the sovereign, and maintained it. He, however, subsequently practically admitted the lack of any moral foundation for his claim by dividing the price, after it had been formally paid him, with the boatmen.

TAXATION IN ENGLAND.—Previous to the reign of Henry II of England (1154), the "tenure" or holding of lands from the crown required the personal attendance, at his own expense, of every tenant—knight or baron—with a certain number of retainers, upon the king in arms, for a period of forty days in each year; and failure to attend, or render the quota of men required by the tenure, would have involved a forfeiture of the tenant's lands for nonperformance of duty. Such a military system, however sufficient for home protection or border warfare, proved ill adapted to foreign wars, which in the case of France were for a long period almost continuous; inasmuch as in those days of slow traveling a forty days' service upon a distant expedition would have been of little account. For what could be more incon-

venient for the leader of an army than to be under the necessity, on the expiration of the forty days, either to cut short the campaign, or purchase, by payments or promises, the continued service of his best soldiers? To overcome this difficulty a new system was arranged, it is said, by Thomas à Becket, which marked an important era in English taxation; whereby the king, in lieu of personal service by his barons and their retainers, agreed to substitute a tax called "*scutage*," or shield tax; which, as levied at the rate of ten marks (£1 6*s.* 8*d.*) on every estate held by tenure, of the annual value of twenty pounds, was *a land tax*, payable in money, which before that period had not been definitely recognized. And thus it was that the king practically disarmed the feudal power by accepting money from the knights in place of armed service; and at the same time greatly strengthened his own power. As with the money thus raised he created a permanent and subservient army of mercenaries—a process which Michelet, the French historian, has characterized as a provision by the nobles of a bit and bridle for their own restraint.*

Historians can find no evidence that the right of the English kings to levy taxes was in any case made contingent on any formal grant of any national council until toward the close of the reign of Richard II (1190);† and we have a statement from the historian Hallam that, previous to that time, the system of extortion practiced by the Norman kings upon their English subjects was "what we should expect to find among Eastern slaves."

Progressive civilization and the necessity for larger revenues

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* The reign of this English king—Henry II—is also signalized by an organization of the royal (state) revenue system which in some of its features has continued to the present time. Under it the management and general superintendance of the royal revenues were intrusted to certain officers of the king's household, who constituted the "Court of the Exchequer," so called from the checkered cloth laid upon the table upon which the tax collectors or treasurers told out the king's money; and the chief financial officer of the British Government at the present time is designated by the title of "Chancellor of the Exchequer." The payments when made were entered into an account book, and from this transferred to a strip of parchment; which last was sent through a pipelike opening into a room specially provided, and called a "tally count," where a "tally" was made of it. This tally was a piece of dry wood on which "the cutter of the tallies" had to cut notches corresponding to the sum paid, while the "writer of the tally" wrote the sum down on both sides of the wood in figures. According to the length of the incision, one notch denoted £1,000; another £100; £20; 20*s.*; 1*s.*; and so on. The chamberlain then split the notched stick down the middle in such a manner that each half contained the written sums and the incised notches. The two matching parts thus split asunder were called "tally" and "counter tally," or "tally" and "foil" (folium). The one was retained by the chamberlain, the other was kept by the payer as a receipt and proof to be produced to the account department of the exchequer. This curious system of receipts was maintained in force until 1783; and it was through the burning, with a view to getting rid of an accumulation of these tally sticks, that the old House of Parliament in London was burned in 1834.

† Constitutional History of England, Stubbs, vol. i, p. 577.

than the domains and perquisites of the crown could supply to meet the expenditures of continued wars and the maintenance of standing armies, gradually, however, broke down (as has been before pointed out) the feudal system for defraying the expenses of the government; and the sovereigns were compelled to petition their tenants in chief, or the representatives of the great estates of their realms, to meet in assembly and co-operate with the crown in raising revenue by a more or less general system of forced contributions upon the persons and property of the people. And in this necessity is to be found the origin of the modern parliaments or states general; and also the inception of the modern system of taxation through the representatives of the people. And the manner in which the great principle that representation should accompany taxation began to find a place in English legal or economic experience, through what was clearly a process of evolution, was undoubtedly as follows:

Under the Saxon and, for a lengthened period, also under the Norman kings, the revenues of the crown (as before shown) were mainly derived from taxes on land, which were paid in kind (produce), and what, as the holders of land were regarded as tenants of the crown, were in the nature of rents.* But when, in order to enlarge the basis of revenue, personal property, in the form of movables or income, was brought under contribution, the situation became different; inasmuch as the titles of all such property not being primarily derived from the king, the consent of its owners to an official inquisition, necessary for proper valuation and assessment, was implied, and naturally was not willingly granted. And the great religious houses and orders, who in the main were the principal owners at this time of such property and were all-powerful, especially insisted that this consent should be recognized as a prerequisite to assessment; and, in at least one instance, re-enforced their position by an interdict from the Pope.

The successive steps, also, by which this great principle became recognized and incorporated into general practice have also been clearly worked out by historians. Thus, in 1181, under the reign of Henry II, each freeman was required to equip himself (for war) according to his means; and to determine what his means were, or his liability for taxation in respect to other than landed property—namely, chattels and income—four or six lawful

* Rents (taxes) paid in kind continued in force in England after the Conquest, and certainly down to the reign of Henry I. Indeed, by reason of the scarcity of money, there was practically no other method of payment. But at the same time the collectors of the king's revenue, in the settlements of their accounts, were accustomed to reckon the value of produce in money at an established ratio: as, an ox at 1*s.*; a sheep at 4*d.*; so many measures of corn at so much, and the like.

men of his parish were chosen to determine and declare under oath the extent of his personal liability. In the next reign, that of Richard I, this new principle of jury assessment was applied in a general way to the assessment of lands as well as chattels; and from thence the representative principle in taxation begins to ascend through successive stages, until it becomes established and recognized as the highest function of the British and all other essentially free governments.*

The abandonment, furthermore, of the right on the part of the sovereign to make arbitrary exactions in respect to personal property, and the assumption by a class of privileged subordinates—i. e., legislators—of the right to vote or deny supplies to the king or state, and for the attainment of which results the English clergy of the thirteenth century led the way, marks also the dawn of constitutional or free government. All authorities are agreed, that on the clause in the Magna Charta of 1215 respecting the taxing power, is based all that has since been achieved in respect to English liberty. By it the king (John) was allowed to reserve for himself but three feudal aids, or rights, for extraordinary money allowances from the state, which very curiously have never been alienated from the English crown by any subsequent legislative enactment. Namely, to ransom the king in the case of his capture by an enemy; to defray the expenses of the knighthood of his eldest son; and third, on account of expenses incident to the marriage of his eldest daughter. In all other respects the charter provides that "no *scutage*"—by which is understood a land tax in commutation for personal military service—"or aid shall be imposed in our realm, save by the Common Council of our realm"; and this provision of the Great Charter was more

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* It is, however, worthy of note that the only time when this subject appears to have prominently attracted the attention of the British Parliament and occasioned debate, was in connection with the imposition of taxes, without representation, on the British colonies in North America, and which assumption of right on the part of the crown to thus act, subsequently led to the American Revolution. The question at issue before Parliament was, had the state the right of taxing the colonies under existing circumstances, in default of representation of the taxpayers? The colonists did not deny the right of Great Britain to tax them; but they did hold that for the people of Great Britain to appropriate any part of the property without their consent was neither reasonable nor consistent with the British Constitution. And in the great debate in Parliament on this subject, in 1764, Mr. Pitt sustained the position of the colonists; and Lord Camden, who followed, said that "taxation and representation were inseparable," and that a blade of grass growing in the most obscure part of the kingdom could not rightfully be taxed without the consent of its proprietor.

Recent historical investigations have, however, shown (as before pointed out, chapter ii) that the grievance alleged and complained of by the American colonists was not peculiar to them, but was shared by the people of the mother country to such an extent that at the time of the colonial revolt not one tenth of them were allowed to participate by vote in the election of members of Parliament.

explicitly reaffirmed and embodied in the form of law by a Parliament in 1297, which enacted that no tax should be levied by the king without the consent of the knights, burgesses, and citizens in Parliament assembled.

Again, in the earlier periods of English history, and probably also in the history of the other states of Europe, when the revenues from the property, fees, and perquisites of the crown, supplemented as they were from time to time by special parliamentary grants, benevolences, and subsidies, and the plunder of special classes—as the Jews—were found inconvenient and unreliable, and were replaced by more regular systems of contribution, the idea of taxation was, as centuries before in Rome, simply to obtain the necessary revenue, without much regard to the incidence of the tax or the interest of the producer, consumer, or trader. The end was alone considered, and not the means; and this policy, pervading all schemes and experiences of taxation, was then, as it ever has been, the most fertile source of bad taxes. The objects from which contributions at the period under consideration could be obtained were almost exclusively tangible and readily visible, as lands, hearths (representing houses), cattle, slaves or serfs, and the crudest of agricultural products. But as trade, or the business of exchanging, increased, it soon came to be looked upon as a proper subject for exaction. Customs, or taxes upon trade, were accordingly very early established, and at first were probably confined to domestic or internal trade. But with the rise and growth of foreign commerce the practice very naturally extended to foreign trade, and the terms "customs" and "duties," which had an antecedent origin and meaning, eventually became restricted in their application to "taxes" or "exactions" on exports and imports. But yet so slowly did the customs in this sense become an important source of English revenue, that the entire amount collected in 1603 was but £127,000, or but little in excess of $600,000. Such taxes at the outset were furthermore held to be the king's private or personal dues, to be levied by him independently of any statute, according to his discretion, or, rather, according to his necessities; and it was not until the reign of Edward I that Parliament undertook to interfere with what had been considered an hereditary right of the crown, by providing in 1275, that for the purpose of correcting irregular seizures and exactions, a limitation should be established on the amount of duty that the king might take on the exports of wool and leather; and the duties thus regulated by statute on these two articles are regarded as the first legal foundation of the English customs revenue. But before the close of the reign of Edward III, or in 1353, the exclusive right of Parliament to authorize or control every form of indirect taxation was fully estab-

lished, and for the time fully exercised; and the right thus achieved by the representatives of the people of participating in the levy of indirect or customs taxation, also necessarily drew with it the right to participate in general legislation, or upon all subjects which Parliament might deem proper.

It is also interesting to recall in connection with this subject, that when the old English kings began to levy tolls on ships entering into harbors, in common with tolls on transportation by roads and navigable streams, the tax was on the ship directly, and not specifically upon its contents. And in early charters instances occur of grants to individuals or monasteries of an exemption from toll for one ship of burden; and in the event of the destruction of the particular ship, the privilege was extended to another ship. But with such tolls or taxes once established, the idea soon developed that like forms of exaction might be made to serve a commercial purpose as well as produce revenue; and, as might have been expected, they therefore early became instrumentalities for fiscal oppression; and, with a view of advancing the interests of English merchants, or of protecting native industries, they were especially directed against the commerce of foreigners. And while the crown, as early as 1275, was deprived of much of its arbitrary power of levying customs for revenue, its prerogative of restraining trade and imposing onerous burdens on exchanges with foreigners remained not only undisturbed but undisputed. Foreign merchants, or trading companies, frequently purchased immunity from such exactions; but yet, according to Mr. Hall, in his History of the English "Customs," "to the 'custos' of the ports, to the riverside baron, to the wayside outlaw and the town apprentice, the Lombard or Flemish peddler or merchant appeared as fair game for violence and extortion of every kind." And in the earlier records of England's customs experience, their oppressive features are of higher interest than their revenue or fiscal characteristics. English producers and traders, furthermore, having secured immunity from arbitrary taxation themselves, were quite willing to see this instrument of restraint and oppression turned against their foreign competitors; and, accordingly, during the whole of the sixteenth, seventeenth, and eighteenth centuries, and the first quarter of the nineteenth century, the whole commercial policy of England was based on the theory of the so-called "mercantile system"; the fundamental principle of which was that commerce could benefit one country only to the extent that it injured another; and that it was the part of wisdom always to secure a favorable balance of trade by selling as much and buying as little as possible, and receiving pay for what was sold, not in other useful products, but in gold.

But notwithstanding the early restrictions imposed by Parliament on the power of the crown to appropriate the property of the people for its support, arbitrary exactions in the name of taxation continued to characterize the rule of all the English monarchs down to the time of Charles I, when the claim of the king to a divine right to take taxes from subjects, with or without their consent, was settled by the dethronement and execution of the monarch and the establishment of the Commonwealth; and ever since then the grants of an annual Parliament have been a prerequisite to any lawful expenditure for the maintenance of the English state.

To the necessities of the Long Parliament, during its contest with the crown, and when the receipts of revenue from former sources were interrupted, we owe the permanent incorporation of the so-called excise taxes into the tax system of England. Another most novel contrivance of this period for the raising of revenue was the so-called weekly impost of a single meal; every citizen being required to retrench one meal per week and pay an amount representing the saving, in the form of money, into the public treasury; a tax that yielded in six years £608,400, or more than $3,000,000; an aggregate that represented a far larger purchasing power than the same amount would at present.

During the nineteen years that elapsed from the beginning of the English Revolution to the restoration of the monarchy under Charles II, the average annual expenditures of the Commonwealth were about seven times greater than those of the preceding royal Government; and as unlawful taxation was the prime cause of the establishment of the Commonwealth, so excessive taxation furnished the prime cause of popular rejoicing when the Commonwealth was got rid of.

A circumstance of no little importance, but which historians generally have overlooked, is, that the revolt of the American colonies and their separation from Great Britain, were in the first instance due to an effort on the part of the landholders of Great Britain to transfer from themselves to the people an ever-increasing portion of the expenses of the Government. But such was the fact. In 1767 the British Parliament, which was mainly composed of landholders, reduced the previously existing land tax to the extent of about half a million pounds per annum; and it was for the purpose of making up a resulting deficiency of receipts to the British treasury, that the Chancellor of the Exchequer of George III resorted to the taxation of tea, glass, and other articles imported into the American colonies, as well as the requirement for the use of stamps on the paper instrumentalities used by the Americans, and the payment for which the colonists resisted.

Finally, a feature of special importance in connection with the history of English tax experiences, one often overlooked in historical essays and discussions, but which ought to command the attention of all interested in the origin of the structure and diversities of governments, is the demonstration it affords of the close connection between taxation and popular liberty. Take up the history of any people, state, or nation that has fought its way, like England, out of despotism into liberty, and what are the transactions that most significantly mark and constitute its progress? The story is substantially the same in every case. First, a government of might supported by arbitrary exactions from persons and property—tribute, *taille, scutage, gabelle, corvée,* escheats, *octroi, vingtième,* customs duties, subsidies, benevolences, and the like—levied at the will or caprice of an absolute and despotic chief or monarch, and without any consultation with or assent of the governed. Then, in some hour of royal adversity or need, the monarch appeals for aid to the more powerful of his subjects—lords and nobles—who, in turn, taking advantage of the situation, vote or grant it, in consideration of the concession of some "Magna Charta," limiting in a measure the sphere of exactions on the part of the monarch, or at least securing to a few of his privileged subordinates a voice in regulating and legalizing the same. Later comes the struggle between the privileged few and the unprivileged many, and sooner or later, by peaceful political progress, or by violence and revolution, the privileged class ceases to be a separate potential element of the state, and thence passes to the people the sole right to determine, through their chosen representatives, what grants of supplies shall be made for the support of the state, and how the burden of taxation which they entail shall be distributed. And then, if further progress is to be achieved, to the end that in exercising the great power of appropriating private property for defraying the expenses of government, no more be taken than is necessary; that none shall be assessed unequally; that the greatest freedom may be secured for production and distribution, and the greatest restrictions placed on monopolies, there must be, through study and investigation, such an improvement and remodeling of all existing systems of taxation as will completely eliminate from them all practices that rest upon no better basis than old prejudices and narrow, selfish interests, and make them conformable to principles and conditions which, when presented abstractly, will command almost universal assent.

THE discovery of a twilight band on Mars is announced by Mr. Percival Lowell, on the authority of observations by Mr. Douglass and Prof. Pickering.

THE PRACTICAL RESULTS OF BACTERIOLOGICAL RESEARCHES.*

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GENTLEMEN: In selecting a subject for my presidential address I have thought it best to restrict myself to that branch of biological science with which I am most familiar; and, as a technical paper might prove uninteresting to many of those who constitute my present audience, I have chosen a title for my address which will enable me to speak in a general way of the development of our knowledge relating to the low vegetable organisms known as bacteria, and the practical results which have been the outcome of researches commenced in the first instance solely on account of their scientific interest.

Attention was first prominently called to the bacteria by the investigations relating to spontaneous generation. It was generally believed prior to the researches of Spallanzini, in 1776, that the development of micro-organisms in boiled organic fluids exposed to the air was by heterogenesis. Spallanzini showed by experiment that in some instances putrescible liquids when boiled and kept in hermetically sealed flasks could be preserved indefinitely without undergoing change. But he was not always successful in this experiment. Bastian, and other supporters of the theory of heterogenesis, at a later date, repeated these experiments with similar results, and maintained that when a development of micro-organisms occurred in a boiled fluid contained in a hermetically sealed flask it could only be by spontaneous generation. But Pasteur, in 1860, gave the true explanation of the appearance of living bacteria under such conditions. He proved that when development occurs it is because the organic liquid has not been completely sterilized, and that certain micro-organisms (spores of bacilli) withstand the boiling temperature, especially when they are suspended in a liquid having an alkaline reaction. At the present day this question is regarded as definitely settled, at least so far as known conditions are concerned; and we have an exact experimental knowledge of the thermal death-point of many micro-organisms of this class.

The principal pathogenic bacteria are destroyed at temperatures much below the boiling point of water. Thus, in experiments made by the present speaker in 1885 it was ascertained that

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* Address of the President of the Biological Society of Washington, delivered December 14, 1895, under the auspices of the Joint Commission of the Scientific Societies of Washington.

the cholera spirillum is destroyed by ten minutes' exposure to a temperature of 52° C.; the typhoid bacillus by 56°; the micrococcus of pneumonia by 52°; the streptococcus of erysipelas (*S. pyogenes*) by 54°; etc. According to Loeffler, the bacillus of glanders is destroyed in ten minutes by a temperature of 55° C.; the bacillus of diphtheria by 60°. The experiments of Yersin show that the tubercle bacillus does not survive exposure for ten minutes to a temperature of 70° C. The practical value of such knowledge is apparent. Articles of clothing infected with any of the pathogenic bacteria mentioned would be speedily disinfected by immersion in water heated to 70° C. or above, and water or milk recently heated to the same temperature would evidently be without danger so far as infection by these "disease germs" is concerned. The recommendation of sanitarians that water or milk or food suspected of being contaminated by pathogenic bacteria should be exposed to a boiling temperature before it is used is based upon the experimental data referred to; and the knowledge that organic liquids can be sterilized by heat constitutes the foundation upon which the bacteriology of the present day has been established. To obtain reliable information with reference to the biological characters of any particular micro-organism it is necessary to experiment with pure cultures, and this requires a sterile culture medium.

It is hardly necessary to call attention to the fact that an immense industry in the preservation of food products depends upon the sterilization of these products by heat, and their preservation in hermetically sealed receptacles.

When Pasteur demonstrated the fact that sterile organic liquids, when protected by a sterilized cotton air-filter, can be kept indefinitely without undergoing any putrefactive or fermentative change, he also proved that such changes are due to the presence of micro-organisms; and, extending his investigations, he found that certain definite kinds of change are due to particular species of low organisms. Thus the alcoholic fermentation of a saccharine liquid was found to be due to a torula (*Torula cerevisiæ*), the acetic fermentation of an alcoholic liquid to a bacterial ferment (Pasteur's *Mycoderma aceti*), etc. Subsequent researches show that alcoholic fermentation may be induced by several species of torula, and even by certain bacteria; while the number of bacterial ferments now known to science is very considerable and is constantly being added to. Among the most important of these we may mention the *Bacillus acidi lactici*, which is the usual cause of the acid fermentation of milk; the various anaërobic bacilli which give rise to the formation of butyric acid in solutions containing starch, dextrin, sugar, or salts of lactic acid; the bacteria which cause the alkaline fermentation of

urine; those which produce marsh gas by the fermentation of cellulose; those which effect the decomposition of albumin, with an evolution of hydrosulphuric acid; those which give rise to the putrefactive decomposition of organic material, the number of which is very large; the bacteria in the soil which reduce nitrates with liberation of ammonia and free nitrogen, and those which oxidize ammonia. The study of these bacterial ferments is still being vigorously prosecuted, and practical results of importance in agriculture and the arts have already been attained. In the future we may look for numerous additions to these practical applications of our knowledge. The use of pure cultures for producing useful fermentations must give the best result with the least liability to loss of material from the presence of undesirable species. It is known that the flavor of butter and of different kinds of cheese is due to various bacterial ferments, and there is good reason to suppose that a better product and greater uniformity would be attained by the use of pure cultures of the species upon which special flavors depend. I understand that in this country quite a number of dairies are now using pure cultures of a certain bacillus (Bacillus 41 of Conn) for giving flavor to their product. It is probable that similar methods will soon be introduced in the cheese-making industry. A recent English publication, which I have not yet seen, is entitled Bread, Bakehouses, and Bacteria. It will, no doubt, be found to contain information of practical value to those engaged in bread-making.

Pasteur's studies relating to the micro-organisms causing abnormal and injurious fermentations in wine, the results of which he published in 1866 (*Études sur le Vin, ses Maladies*, etc.), have resulted in an enormous saving to the wine-making industry in France and other countries where wine is produced upon a large scale; and his investigations relating to the cause and prevention of the infectious diseases of the silkworm, which threatened to destroy the silk industry in France, have resulted in even greater benefits to the material interests of his country and of the world (published in 1870).

Agricultural chemists predict that in the near future cultures of the nitrifying bacteria of the soil will be made on a large scale for the use of farmers, who will add them to manures for the purpose of fixing the ammonia, or perhaps will distribute them directly upon the soil. Should this prove to be a successful and economic procedure, the extent of the interests involved will make it a "practical result" of the first importance. Another application of our recently acquired knowledge which has already proved useful to farmers in certain parts of Europe relates to the destruction of field mice by distributing in the grain fields bread

moistened with a culture of a bacillus which causes a fatal infectious disease among these little animals.

In Greece, in Hungary, and in other parts of Europe the quantity of grain consumed by field mice constitutes a very serious loss. Recent experiments made with cultures of two different bacilli (*Bacillus typhi murium* of Löffler and the bacillus of Lasar) show that it is practicable to destroy these pests, in the fields where their depredations are committed, in the manner indicated. Mice which consume the bread moistened with cultures of one of the pathogenic bacilli referred to die within a short time from general infection, and their bodies are consumed by other mice, which also become infected. Thus a veritable epidemic is induced by which their numbers are very materially reduced.

This leads us to the subject of the prevention of infectious diseases among domestic animals. We have now a precise knowledge of the specific infectious agents ("germs") in the diseases of this class which have caused the greatest losses. The most important of these are anthrax, glanders, tuberculosis, infectious pleuro-pneumonia, swine plague, hog cholera, hog erysipelas, and fowl cholera. All of these have been proved to be due to bacterial parasites, the morphological and biological characters of which are now well known. The infectious agent and usual mode of infection being known in any given disease, we have a scientific basis for measures of prophylaxis. These naturally include the destruction of the specific micro-organism to which the disease is due wherever it may be found. An enormous amount of experimental work has been done for the purpose of determining the comparative value of disinfecting agents and the practical advantages of each, having in view questions relating to cost, stability, solubility, odor, toxic properties, etc., also to the difference in resisting power of different pathogenic bacteria, the presence or absence of spores, the character of the material with which they are associated, etc. As a result of this extensive laboratory work our knowledge with reference to the efficiency and availability of agents of this class is very complete, and enables those who are familiar with the experimental evidence to formulate rules for the destruction of the various pathogenic bacteria wherever they may be found. The infected animal is itself a focus of infection which under certain circumstances had better be destroyed *in toto*, the individual being sacrificed and the body put out of the way of doing harm by means of cremation or burial. Under other circumstances it may be sufficient to isolate the infected animal and to disinfect all discharges containing the pathogenic germ and all objects contaminated by such discharges. By such measures the extension of epidemic diseases fatal to

domestic animals may usually be arrested. But it may happen that the extent of the epidemic prevalence and the number of animals already exposed to infection make these measures inadequate or difficult of execution. In this case we have, for certain diseases, another method of prophylaxis which has been extensively employed with excellent results. I refer to the method of protective inoculations, which we owe largely to the genius and patient researches of the distinguished French chemist Pasteur and his pupils.

Toussaint, a pioneer in researches relating to protective inoculations, has a short paper in the Comptes-Rendus of the French Academy of Sciences of July 12, 1880, entitled Immunity from Anthrax (*charbon*) acquired as a Result of Protective Inoculations.

In this paper he announces his discovery of the important fact that the anthrax bacillus does not form spores in the tissues or liquids of the body of an infected animal, but multiplies alone by binary division: "*Sa multiplication se fait toujours par une division du mycélium.*"

In the same communication he reports his success in conferring immunity upon five sheep by means of protective inoculations, and also upon four young dogs. We must therefore accord him the priority in the publication of experimental data demonstrating the practicability of accomplishing this result.

In a communication made to the French Academy of Sciences, September 27, 1880, Pasteur gave an account of an experiment made July 14, 1879, upon two cows, which, in connection with a subsequent experiment, made August 6, 1880, upon four cows, led him to the conclusion that a single attack of anthrax protects from subsequent attacks.

The next important steps in the line of experimental research leading to protective inoculations in the disease under consideration were reported by Pasteur in his communication to the French Academy made at the *séance* of February 28, 1881 (with the collaboration of Chamberland and Roux), entitled *De l'Atténuation des Virus et de leur Retour à la Virulence.* In this connection Pasteur announces his discovery of the fact that when cultivated at a temperature of 42° to 43° C. the anthrax bacillus no longer forms spores and rapidly loses its virulence.

In a later communication (March 21, 1881) Pasteur says that he has found by experiment that when attenuated varieties of the anthrax bacillus form spores, these again reproduce the same pathogenic variety, so that cultures of each degree of attenuation can be maintained indefinitely.

On June 13, 1881, Pasteur communicated the results of his famous experiment at Pouilly-le-Fort, near Melun. He says:

"On the 5th of May, 1881, we inoculated, by means of a Pravaz syringe, twenty-four sheep, one goat, and six cows, each animal with five drops of an attenuated culture of the anthrax bacillus. On the 17th of May we reinoculated these animals with a second virus, also attenuated, but more virulent than the first.

"On the 31st of May we proceeded to make a very virulent inoculation in order to test the efficacy of the preventive inoculations made on the 5th and 7th of May. For this experiment we inoculated the thirty vaccinated animals, and also twenty-four sheep, one goat, and four cows which had not received any previous treatment.

"The very virulent virus used on the 31st of May was obtained from spores preserved in my laboratory since the 21st of March, 1877.

"In order to make the experiments more comparable, we inoculated alternately a vaccinated and a non-vaccinated animal. When the operation was finished, all those present were invited to reassemble on June 2d—i. e., forty-eight hours after the virulent inoculation was made.

"Upon the arrival of the visitors on June 2d, all were astonished at the result. The twenty-four sheep, the goat, and the six cows which had received the attenuated virus all presented the appearance of health. On the contrary, twenty of the sheep and the goat which had not been vaccinated were already dead of anthrax; two more of the non-vaccinated sheep died before the eyes of the spectators, and the last of the series expired before the end of the day. The non-vaccinated cows were not dead. We had previously proved that cows are less subject than sheep to die of anthrax. But all had an extensive œdema at the point of inoculation, behind the shoulder. Certain of these œdematous swellings increased during the following days to such dimensions that they contained several litres of liquid, deforming the animal. One of them even nearly touched the earth. The temperature of these cows was elevated 3° C. The vaccinated cows did not experience any elevation of temperature, or tumefaction, or the slightest loss of appetite. The success, therefore, was as complete for the cows as for the sheep."

Subsequent experience has fully established the value of protective inoculations in this disease, and the method of Pasteur has been practiced on a large scale in France, Austria, Russia, and Switzerland.

The results of anthrax inoculations made in France by Pasteur's method during twelve years were summarized by Chamberland in 1894. The veterinarians who made the inoculations were each year called upon to answer the following questions: 1. Number of animals inoculated. 2. Number of deaths from first

inoculation. 3. Number of animals dying within twelve days after the second inoculation. 4. Number of animals dying of anthrax within a year after protective inoculations. 5. The yearly average loss before inoculations were practiced. The total number of animals inoculated during the period to which this report refers was 1,788,677 sheep and 200,962 cattle. The average annual loss before these protective inoculations were practiced is said to have been about ten per cent for sheep and five per cent for cattle. The total mortality from this disease among inoculated animals, including that resulting from the inoculations, was 0·94 per cent for sheep and 0·34 per cent for cattle. Chamberland estimates that the total saving as a result of the inoculations practiced has been five million francs for sheep and two million francs for cattle.

Podmolinoff gives the following summary of results obtained in 1892 and 1893 in the government of Kherson (Russia): Number of sheep inoculated, 67,176; loss, 294 = 0·43 per cent. Number of horses inoculated, 1,452; loss, 8. Number of cattle inoculated, 3,652; loss, 2. The conclusion is reached that Pasteur's method of inoculation affords an immunity against infection with virulent anthrax bacilli in greater amounts than could ever occur under natural conditions.

Another disease in which inoculations have been practiced on a large scale is erysipelas of swine (*rouget* of French authors), which prevails extensively in France and other parts of Europe.

Pasteur's first studies relating to the ætiology of *rouget* were made in collaboration with Chamberland, Roux, and Thuillier in 1882. Pasteur found that the virulence of his cultures was increased by passing them through pigeons and diminished by passing them through rabbits. By a series of inoculations in rabbits he obtained an attenuated virus suitable for protective inoculations in swine. In practice he recommended the use of a mild virus first, and after an interval of twelve days of a stronger virus. These inoculations have been extensively practiced in France, and the fact that immunity may be established in this way is well demonstrated.

In a paper published in 1894 Chamberland states that in the preceding seven years, during which time protective inoculations had been practiced in France on a large scale, the mortality from *rouget* had been reduced to 1·45 per cent, whereas before these inoculations were practiced the mortality from this disease was about twenty per cent.

Hutyra has given the following statistics of inoculations made in Hungary during the year 1889 with "vaccines" obtained from the Pasteur laboratory in Vienna: 48,637 pigs were inoculated on 117 different farms. Of these, 143 (0·29 per cent) died between the

first and second inoculations. After the second inoculation 59 animals died (0·1 per cent). During the year following the inoculations 1,082 inoculated pigs died of *Rothlauf*. Before the inoculations the annual loss in the same localities is said to have been from ten to thirty per cent.

In a communication (1894) to the Central Society of Veterinary Medicine (of France), Arloing claims that he has demonstrated the ætiological relation of a bacillus first described by him in 1889 (*Pneumobacillus liquefaciens bovis*) to the infectious disease of cattle known as pleuro-pneumonia. The demonstration was not complete until recently, because of failure to reproduce the disease by inoculation with a pure culture of the bacillus.

Although this demonstration is of such recent date, protective inoculations against this disease have long been successfully practiced. For this purpose serum obtained from the lungs of an animal recently dead has been employed, this having been proved by experiment to be infectious material, although the exact nature of the infectious agent present in it was not determined.

In the Bulletin of the Central Society of Veterinary Medicine of May 24, 1894, M. Robcis reports the results of inoculations made with cultures of Arloing's *Pneumobacillus liquefaciens bovis*, and with injections of pulmonary serum. His statistics with reference to the last-mentioned "legal" inoculations he has obtained from official documents relating to the Department of the Seine.

The total number of infected localities in this department during the years 1885 to 1891 was 1,253; total number of contaminated animals, 18,356; total number inoculated, 18,359; total number of deaths prior to inoculation, 1,753; total number of deaths after inoculation, 2,741; total number of deaths due to the inoculation, 94; total percentage of mortality, 22·8 per cent. After discussing these and other statistics Robcis arrives at the conclusion that Arloing's method of preventive inoculations with cultures of the *Pneumobacillus liquefaciens bovis* gives better results than the legal method with serum from an infected animal, the total loss among animals exposed to contagion not being over twelve to fourteen per cent.

In the infectious disease of cattle known under the names of "black leg," "quarter evil," or symptomatic anthrax, protective inoculations have also been practiced with success. The disease prevails during the summer months in various parts of Europe, and to some extent in the United States. It is characterized by the appearance of irregular, emphysematous swellings of the subcutaneous tissues and muscles, especially over the quarters. The muscles in the affected areas have a dark color and contain a bloody serum in which the bacillus is found to which the disease

is due. This is an anaërobic bacillus which forms large oval spores.

The ætiology of the disease was first clearly established by the researches of Arloing, Cornevin, and Thomas (1880 to 1883).

Strebel, in 1885, published the results of protective inoculations made in Switzerland in 1884. The inoculations were made in the end of the tail with two "vaccines," with an interval between the two of from nine to fourteen days. The vaccines were prepared by exposure to heat, as recommended by Arloing, Cornevin, and Thomas. The most favorable season for inoculations was found to be the spring, and the most favorable age of cattle for inoculation from five months to two years.

In seven Swiss cantons 2,199 cattle were inoculated; 1,810 inoculations were made among animals which were exposed in dangerously infected pastures. Of these but two died, one two months and the other four months after the protective inoculations. Among 908 inoculated cattle, which were pastured with 1,650 others not inoculated, the mortality was 0·22 per cent, while the loss among the latter was 6·1 per cent. The following year (1885), according to Strebel, the number of inoculations, exclusive of those made in the canton of Bern, was 35,000. The losses among inoculated animals are reported as having been about five times less than among those not protected in this way.

In the Bulletin of the Central Society of Veterinary Medicine of France (1892) Guillod and Simon give the results of 3,500 inoculations made since 1884. The mortality among cattle in the region where these inoculations were practiced had been from ten to twenty per cent, but fell to 0·5 per cent among the inoculated animals.

The success of Pasteur's method of prophylaxis against hydrophobia is now well established, although the specific germ of this disease has not yet been demonstrated.

Perdrix (1890), in an analysis of the results obtained at the Pasteur Institute in Paris, calls attention to the fact that the mortality among those treated has diminished each year, and ascribes this to improvement in the method. He says:

"At the outset it was difficult to know what formula to adopt for the treatment of each particular case. Upon consulting the accounts of the bites in persons who have died of hydrophobia, notwithstanding the inoculations, we have arrived at a more precise determination as to the treatment suitable for each case, according to the gravity of the lesions. In the cases with serious wounds we inject larger quantities of the emulsion of cord and repeat the inoculations with the most virulent material. For the bites upon the head, which are especially dangerous, however slight their apparent gravity may be, the treatment is more rapid,

and, above all, more intensive—that is to say, the virulent cord is injected several times."

The statistics arranged with reference to the location of the bite are given by Perdrix as follows:

Bitten upon the head,	684;	died,	12 = 1·75 per cent;
Bitten upon the hands,	4,396;	died,	9 = 0·2 per cent;
Bitten upon the limbs,	2,839;	died,	5 = 0·17 per cent.

In the infectious diseases of man, which have been proved to be due to pathogenic bacteria, the most satisfactory evidence of the value of protective inoculations has been obtained in cholera and in diphtheria. In the first-mentioned disease protective inoculations were practiced on a large scale in Spain, during the epidemic of 1884 and 1885, by the method of Ferran. This consisted in the introduction of a small amount of a pure culture of the cholera spirillum into the subcutaneous connective tissue, by means of a hypodermic syringe. Shakespeare, who was sent by our Government to investigate the merits of this method of prophylaxis, was disposed to think well of it. He says:

"There is still another result of the preventive inoculations of Ferran apparently shown by these statistics. I refer to the apparent marked shortening of the course of the epidemic after a large percentage of the inhabitants have become inoculated. It would seem, therefore, from analysis of the official statistics, that the practice of the anticholeraic inoculation after the method of Ferran, besides giving the subject inoculated a considerable immunity from attack and death by cholera, furnishes a means of bringing an epidemic rapidly to an end."

More recently Haffkine has advanced evidence in favor of the protective value of subcutaneous inoculations with cholera cultures. His experiments in India have been made in Calcutta, Gaya, Cawnpore, and Lucknow. Those exposed, during the epidemic prevalence of cholera, under the same conditions as to locality, water supply, etc., are divided into two groups, the inoculated and the non-inoculated. In the first group, which includes 500 inoculated individuals, 21 cases occurred, of which 19 were fatal, a mortality of 3·8 per cent. In the second group were 1,735 individuals; the number of cases in this group was 174; number of deaths, 113; percentage of mortality, 6·51.

Whether this method will be found to have any great practical value can only be determined by more extended experiments. But in view of the fact that other measures of prophylaxis, well known to sanitarians, are sufficient for the prevention of cholera epidemics, and that nurses and others who necessarily come in contact with cholera patients are not likely to contract the disease if they use proper precautions with reference to their food and

drink, the disinfection of their hands, etc., we doubt whether protective inoculations will ever come into general use as a measure of prophylaxis against this disease. Certainly they can not take the place of those sanitary measures which have been proved to be sufficient for the prevention of epidemics—namely, exclusion by a proper inspection service at ports of entry ("quarantine"), isolation of the sick, disinfection of excreta, general sanitary police of exposed towns and cities, boiling the water used for drinking purposes, etc.

But it must be remembered that these measures of prophylaxis, which have undoubtedly resulted in the saving of thousands of lives, are based upon exact knowledge obtained as a result of bacteriological researches. Since the discovery of the cholera spirillum by Koch in 1884, a very large number of skilled investigators have devoted themselves to researches relating to it, and especially to questions relating to its resistance to various destructive agencies. These researches show that it is quickly destroyed by a comparatively low temperature (60° C.), by desiccation, and by all known germicidal agents. It is especially susceptible to the action of acids, in comparatively dilute solutions. Our measures of sanitary prophylaxis are therefore established upon a sound experimental basis, and the extension of the disease in civilized countries is the result of a failure to apply well-known means of prevention. As a matter of fact, these measures have been successful in excluding the disease from this country during the last two widespread epidemics in Europe, and have enabled sanitarians to greatly restrict the epidemic spread of the disease in those countries into which it has recently been introduced.

The prevalence of typhoid fever has also been greatly restricted by measures based upon an exact knowledge of the biological characters of the typhoid bacillus, and if the recommendations of sanitarians were fully complied with there is reason to believe that it would be practically banished from our cities and towns.

The bacteriological examination of the water supply of towns and cities is now generally recognized as an important matter, as indicating the sanitary purity of the supply. The detection of the dangerous pathogenic species should lead to the disuse of a water for drinking purposes, or to the recommendation that it be boiled before it is used. The presence of certain other bacteria indicates sewage contamination and consequent danger to those drinking the water without proper precautions as to filtration or sterilization. In Berlin, where the water supply is taken from a river known to be contaminated by sewage, it is passed through carefully constructed "filter beds," and expert bacteriologists

make frequent tests to ascertain how well these filter beds are accomplishing their purpose. In France the Pasteur-Chamberland filter is largely used, and recent reports indicate that it has been instrumental in effecting a great reduction in the rate of mortality from typhoid fever, especially among the French soldiers in certain parts of the country where this disease a few years since caused a considerable mortality, and where the civil population, not using the filters, still furnishes many victims to this disease.

The exact knowledge which we now possess with reference to the micro-organisms which are the cause of erysipelas, puerperal fever, septicæmia, wound infection, etc., has also led to the employment of intelligent measures of prophylaxis. The brilliant success which has attended the carrying out of these modern antiseptic and aseptic methods in surgical and obstetrical practice are too well known to call for extended remark. But some statistics relating to this branch of our subject may serve to impress the matter upon the minds of those who have not fully appreciated the saving of life which has resulted from the employment of methods based upon a knowledge of the usual modes of wound infection and the micro-organisms to which such infection is due. Lister, the distinguished pioneer in the employment of antiseptics in surgical practice, reports that during the years 1864, 1865, and 1866, before he resorted to the use of antiseptics, the mortality in his surgical cases exceeded forty-five per cent, largely from septic complications. During the period from 1871 to 1876, in a total of 453 surgical cases treated by him with strict antiseptic precautions, the mortality from such complications was only 0·36 per cent.

The German surgeon Volkmann reports that prior to the introduction of antiseptic methods the mortality from compound fractures in his practice was forty per cent. After adopting Lister's methods he had 135 successive cases of compound fracture without a death from septic causes; two deaths only occurred out of the whole number of cases; one of these was the result of delirium tremens and the other of fatty embolism of the lungs.

Brignot, a French surgeon, reports that in French hospitals the mortality from major surgical operations before the introduction of antiseptic methods was 52·5 per cent, and that since it has been reduced to a little less than eleven per cent. In a series of 736 cases of compound fracture collected by Prof. William White, of Philadelphia, all of which occurred before the introduction of antiseptic methods, the mortality was forty per cent. In a second series of similar cases in which these methods were employed the mortality was only four per cent. Dennis, of New York, has reported a series of 516 cases of compound fracture without a single death from septic causes.

Thirty years ago the mortality from puerperal septicæmia in lying-in hospitals was frequently something frightful. In the *Maison d'Accouchements* in Paris the mortality rate at times was as high as one out of every three patients delivered. Similar conditions existed in Berlin and in other European cities. At the present day the mortality from septic infection in similar cases is even less than in private practice. In the Maternity Hospital of New York, for example, in one thousand deliveries there were but six deaths, and but one of these was due to puerperal septicæmia.

If we take a more general view of the results attained in preventive medicine by the application of modern methods based upon our knowledge of the causes of infectious diseases, we shall find that a very large saving of life has been accomplished, as shown by diminished mortality rates in all parts of the civilized world. This is well illustrated by the carefully kept English statistics. The facts are very concisely stated by Sir Edwin Arnold in an address recently delivered at St. Thomas's Hospital upon Medicine, its Past and Future. He says:

"One of the high authorities already quoted has furnished a calculation of the salvage of life effected, even during the early years of the present reign, by the commencing improvements in preventive and curative medicine. In the five years from 1838 to 1842 London, with an average population of 1,840,865 persons, had an average annual mortality of 2,557 in every 100,000. In the five years from 1880 to 1884 the average metropolitan population was 3,894,261, and the average annual death-rate 2,101 in each 100,000. A calculation will show that these figures represent a saving or prolonging of lives during that lustrum to the number of 96,640. The mean annual death-rate has now been reduced to a point lower than shown in these. It was 22·16 per 1,000 for England and Wales at the commencement of the reign, and it is to-day better than 19·0 per thousand, while in her Majesty's army and navy the diminution of mortality apart from deaths from warfare has proved even more remarkable, and in India, where we used to lose 69 per 1,000 yearly, this has been reduced to 16 per 1,000."

We can not claim that this reduction in the mortality rate is due alone to the development of our knowledge relating to the pathogenic bacteria, for much had been accomplished by practical measures of sanitation before we had any exact knowledge of disease germs. But this exact knowledge has added greatly to our sanitary resources, and has doubtless been an important factor in the reduction in the mortality rate which has occurred within the past twenty-five years. Sir Edwin Arnold, in the address above referred to, says:

"A great authority has declared that 'a day will come when

in London, in Berlin, in Paris, man will not die of diphtheria, of typhoid, of scarlet fever, of cholera, or of tuberculosis, any more than he dies in these cities to-day of the venom of snakes or of the tooth of wolves.'"

But it is not alone in preventive medicine that important practical results have been accomplished. Therapeutics has also been greatly and favorably influenced by the discovery of the specific germs of a considerable number of infectious diseases. Naturally, the effort is to destroy these germs at the focus of infection, or to render the conditions in the body of the infected individual unfavorable for their development. When the focus of infection is superficial or within comparatively easy reach, as in erysipelas or diphtheria, local treatment with germicidal agents is often attended with favorable results. But when the deeper tissues and organs of the body are invaded, or the germ multiplies abundantly in the blood, but little can be accomplished by the use of agents of this class. Our bacteriological researches have, however, recently resulted in the discovery of a method of treatment which has been employed with remarkable success in two of the infectious diseases of man, and which there is reason to believe may eventually be found to have a more extended application. I refer to the therapeutic use of antitoxins contained in, or obtained from, the blood of animals rendered immune by repeated inoculations with cultures of a specific disease germ. The diseases in which the greatest success has been attained by this mode of treatment are tetanus and diphtheria. As the last-mentioned is by far the most important from a practical point of view, I will confine my remarks to the results of treatment in this disease. Fortunately, I have at hand a recent summary of the clinical evidence in favor of this mode of treatment, made by a very competent and conservative physician—Prof. William H. Welch, of the Johns Hopkins University. Prof. Welch concludes his paper as follows:

"The principal conclusion which I would draw from this paper is that our study of the results of the treatment of over seven thousand cases of diphtheria by antitoxin demonstrates beyond all reasonable doubt that antidiphtheric serum is a specific curative agent for diphtheria, surpassing in its efficacy all other known methods of treatment for this disease. It is the duty of the physician to use it."

A recent report on antitoxin treatment in Germany, obtained by collective investigation, on a total of 10,312 cases occurring in a period of six months from October 1, 1894, gives very striking results. Of the whole number, 5,833 were treated with serum, and 4,479 without it. The proportion of deaths in the former group was 9·6 per cent, in contrast to 14·7 per cent in the latter.

In 401 cases of children under the age of two years, in which the serum treatment was used on the first and second day, the mortality rate was 11·8, in contrast with 39·7 where under similar conditions it was not used. Of 2,556 children between two and ten years of age, the death-rate was 4 per cent after antitoxin treatment, instead of 15·2 per cent in the other group.

Prof. Welch very truly and forcibly remarks: "The discovery of the healing serum is entirely the result of laboratory work. It is an outcome of the studies of immunity. In no sense was the discovery an accidental one. Every step leading to it can be traced, and every step was taken with a definite purpose and to solve a definite problem."

The importance of prompt treatment in this very fatal malady is shown by the following figures which we take from Prof. Welch's paper. The cases referred to were reported by nineteen different observers, and the total number treated was 1,489, with a mortality of 14·2 per cent. Of these cases, 222 were treated with the antitoxic serum on the first day of sickness, with a mortality of 2·2 per cent; 456 cases on the second day, with a mortality of 8·1 per cent; 311 on the third day, with a mortality of 13·5 per cent; 168 on the fourth day, with a mortality of 19 per cent; 116 on the fifth day, with a mortality of 29·3 per cent; 44 on the sixth day, with a mortality of 34·1 per cent; 104 after the sixth day, with a mortality of 33·7 per cent; 68 undetermined.

The time at my disposal will not permit me to dwell longer upon the practical results already attained in preventive medicine and in specific therapeutics as a result of bacteriological investigations. But before closing I desire to call attention, as briefly as possible, to the value of the recent additions to our knowledge relating to the causes of disease, in the way of an exact and early diagnosis. In certain infectious diseases such knowledge is of great importance, not only in the interest of the patient, but of others liable to infection. This is especially true in diphtheria and in tuberculosis of the lungs. In the first-mentioned disease an early differentiation of true diphtheria from pseudo-diphtheria is often impossible without resort to methods by which the bacteriologist is able to detect the presence of the diphtheria bacillus. In pulmonary tuberculosis, also, the bacteriologist can usually detect the tubercle bacillus in the sputa before the clinical expert can recognize with certainty the physical signs of the disease. Scientific physicians in all parts of the world now resort to the use of the microscope and the staining methods by which this bacillus is recognized for making an early diagnosis in cases of this nature. Other diseases in which the recognition of the specific germ establishes the diagnosis are relapsing fever, typhoid fever, glanders, and anthrax—the two last

mentioned being diseases of lower animals which may be transmitted to man. And in tuberculosis and glanders affecting domestic animals we have still another method of establishing the diagnosis in suspected cases. This is by the subcutaneous injection of a proper dose of a filtered culture of the specific pathogenic bacteria. These filtered cultures, containing the soluble toxic products developed during the growth of the bacillus, are known in the one case (tubercle bacillus) as tuberculin, and in the other (glanders bacillus) as mallein. The effect is similar in each case. When an animal infected with tuberculosis receives a suitable dose of tuberculin a characteristic febrile reaction is produced. In the non-infected animal this reaction does not occur. The same is true as regards animals infected with glanders which receive a dose of mallein. This test of infection is now extensively used both in this country and in Europe with very satisfactory results. The importance of an early recognition of these chronic infectious diseases is apparent. The danger from infected animals is not limited to the extension of the disease to others of the same species, but in tuberculosis those who consume the milk are exposed to the danger of infection, especially in cases where the udder of the animal is the seat of a tubercular infection.

I have by no means exhausted my subject, and an attempt to do so would probably exhaust the patience of my audience. In conclusion, I would say that the painstaking laboratory work which has led to the important practical results referred to is still being prosecuted with unabated vigor, and without doubt we may look for further valuable additions to our knowledge. These, together with a wider appreciation of the present status of this department of scientific investigation, can not fail to add largely to the practical results which will hereafter be achieved in the field of preventive medicine and of specific therapeutics, and in agriculture, in the dairy, etc., as heretofore indicated.

THE Prince of Monaco recently reported to the French Academy of Sciences on the results of his deep-sea dredging expedition of 1895, from Portugal to the Azores and back to the English Channel. The dredgings were carried to the depth of forty-two hundred metres, where weirs were deposited; and numerous soundings were made, some of them as far down as five thousand metres, and specimens of the water drawn up. Fine captures were made in the weirs from fifteen hundred metres, in which echinoderms, mollusks, and fishes were plentiful. Thus, three hundred and fifty-five animals were taken in twenty-four hours in the same net—three hundred of them fishes, large red shrimps, and cephalopods. Besides the usual fauna of such profundities, crayfishes eighty centimetres long and superb holothurias of forty-six centimetres were drawn up from the depth of four thousand metres.

TROPICAL FRUIT TREES.

By BERTHA F. HERRICK.

ALTHOUGH the fruits of the tropics seldom ripen in temperate climates, the trees are often cultivated merely for the beauty of their foliage; so that it may prove of interest to become further acquainted with their general appearance and uses in their far-off native habitats.

The beautiful date palm is indigenous to Africa and Asia, though flourishing in all hot countries. There are said to be nearly a thousand species, the most vigorous specimens reaching the height of eighty feet and living for two hundred years. Each tree yields from one hundred and sixty to two hundred pounds of fruit in a single season, some of the clusters weighing nearly forty pounds. It is propagated by suckers from the root, whence its name of "Phœnix," and bears its first crop when about eight years of age.

No less than three hundred and sixty uses are claimed for this invaluable tree. The trunk furnishes timber for furniture and house-building as well as fuel, cooking utensils, and bows and arrows; the roots are utilized for fencing and roofing, and the fiber is woven into mats, fishnets, ropes, baskets, and articles of clothing. Among the natives of the Orient the nutritious fruit is the principal food for nearly the entire year, and, pounded into solid cakes, is carried by Arabs journeying over the scorching desert, the stones being used as fodder for the camels. Roasted and ground, the kernels make a fair substitute for coffee, and are also valued on account of their oil.

These trees are sometimes known as the "palms of victory," as the large, frondlike leaves are supposed to be identical with those that were strewn before the Saviour on his entry into Jerusalem, and that were borne with songs of rejoicing before ancient conquerors returning from their triumphs on the battlefield; while on Palm Sunday and at the Jewish Feast of Tabernacles they are highly prized as church decorations. In some varieties the flower-spathes yield a large quantity of sweet sap, which upon evaporation becomes "date sugar," this being fermented into an intoxicant called "arrack." The terminal bud or "cabbage" is considered a great delicacy, and is boiled and eaten like a vegetable.

Another well-known fruit tree of the tropics is the graceful *Musa*, or banana, a relative of the plantain. The rapidly growing suckers are productive at any season of the year, in a period of from nine to eighteen months, according to the altitude, the tree dying after ripening several bunches, some of which weigh nearly

eighty pounds. Many of the large, handsome leaves—usually torn to fringes by the trade winds—measure ten feet in length by two

BANANA TREE.

feet in breadth, their uppermost crests waving twenty feet above the ground.

From the fibrous petioles or leaf stalks is manufactured a fine, white flax, which is woven into delicate muslins, or, when in a half-finished state, is used for tinder or wadding; while one variety in the Philippine Islands furnishes the well-known Manilla hemp.

Green bananas are sometimes dried and ground into meal or

flour, which is baked or fried in cakes. So common is this fruit in the tropics that a huge cluster may be purchased for the trifling sum of twenty-five cents, and a generous bunch always hangs in the hallway or on the veranda of the hospitable planter's home.

Tradition claims that plantains flourished in the Garden of Eden, together with the "tree of life" and "the tree of the knowledge of good and evil." They are larger and more succulent than bananas, and are used for almost the same purposes. Like the

BREADFRUIT TREE.

date-palm and the cocoanut tree, the "cabbage" of this plant is a favorite article of diet.

The breadfruit, or *Artocarpus*, is a native of the Indian Archi-

pelago and the islands of the Pacific. It attains an elevation of about fifty feet, and grows wild in the forests. The leaves are large, glossy, and deeply pinnated, like the fronds of a fern, and the fruit resembles a muskmelon—the edible interior being of the

LOWER PART OF MANGO TREE. Hawaiian Islands.

consistence of newly baked bread, and tasting like batter-pudding or boiled milk and potatoes. It is sometimes fried in slices, and served with meat as a side dish, or eaten with milk and sugar; but the usual mode of preparation is to bake the unripe quartered portions in rude ovens of heated stones, arranged in layers with earth and leaves, on the same principle as scalloped oysters. As there are many varieties, ripening at different seasons of the year, the supply is practically inexhaustible. Some kinds yield valuable timber, and from the inner bark of other species the natives manufacture clothing.

The "Jack-fruit"—a South Sea representative—is long and gourdlike, and weighs from twenty to sixty pounds. Although most of the crop is borne on the boughs, in the usual manner, some of the fruit grows directly on the bare trunk, a foot or two from the ground, presenting a very singular appearance. It

ripens numerous seeds, which are considered very nutritious, and are eaten like chestnuts.

An Indian tree of great beauty and interest is the tamarind, with its thick, lofty trunk, wide-spreading branches, and clusters of purplish or yellowish flowers. So fine and light is the foliage that the Koran doomed lost souls in hell to have their thirst quenched only once in a thousand years with as much water as could be held in a single leaflet. The long, narrow pods contain citric and tartaric acid, sugar, and potash, and are imported in large quantities from the East and West Indies, to be utilized in various economies.

The fruit of the curious *papaya*, sometimes called the papaw, suggests a pumpkin in taste and general appearance, and a score or more are attached in a mass to the naked stem, immediately beneath the crest of leaves. As they contain a large amount of pepsin, they are widely used medicinally; and tough meat, wrapped for a couple of hours in one of the leaves, becomes exceedingly tender, and in time almost rotten.

OHIAS, OR MOUNTAIN APPLES.

There are numerous kinds of guavas, the best being the red and the white species, which are famous for their jelly-making possibilities. The fruit is about the size of a small apple, and is obtainable at nearly every season of the year.

The mango came originally from Hindostan, and is a magnificent shade tree, forty feet high, with leaves something like those of a peach tree, and quantities of juicy yellow plummets, suspended from the branches by very long, slender stems. Some wild varieties have an unpleasant taste of turpentine, but the better-flavored sorts are manufactured, when in an unripe state, into preserves and pickles for exportation.

The shining emerald leaves and the pretty scarlet flowers of the pomegranate (*Punica granatum*) are familiar to nearly every one who owns a garden or frequents a city park. The fruit of this

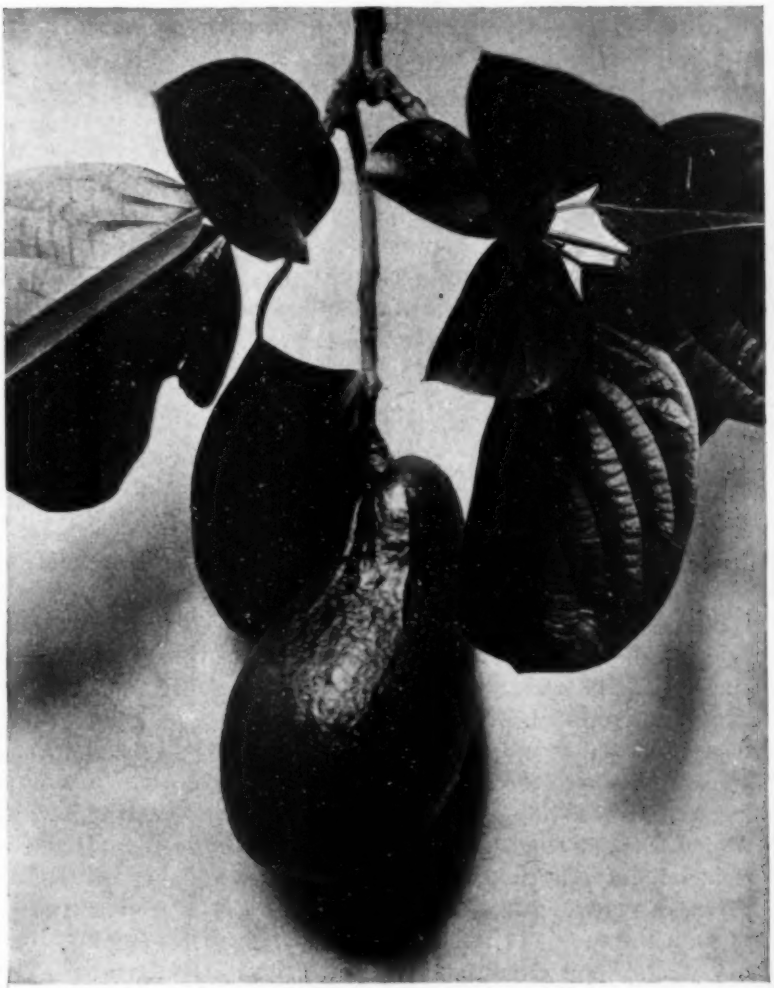
plant was mentioned by Moses as one of the attractions of the Promised Land; and he was commanded to make golden pomegranates and their blossoms alternately on the hem of the ephod; while four hundred specimens of these curious globes

OHELO, OR HAWAIIAN HUCKLEBERRY.

were wreathed around the capitals of the two brass pillars of King Solomon's temple.

Various parts of this shrub were used by the ancients for medicine, and the bitter juice furnished a light but indelible blue stain.

The *ohia,* or Malay apple, is a common timber tree of the Hawaiian Islands, though not peculiar to that locality. On the Island of Maui is a mammoth orchard of wild ohias, extending from the sea to the mountains, and measuring twenty miles in length by from five to ten miles in width. The trees are from forty to fifty feet in height, some of the largest yielding nearly



AVOCADO, OR ALLIGATOR PEAR.

fifty pounds of fruit, the total crop being said to be sufficient to fill a fleet of one hundred steamers. The beautiful crimson or white apples, however, are unfit for transportation, as they last but a short time in a good condition.

Near the Volcano House on the island of Hawaii are great thickets of the *ohelo,* or Hawaiian huckleberry (*Vaccinium*

reticulatum), which the natives consider sacred to Pele, the goddess who is supposed to preside over the famous crater of Kilauea; and which, together with white pigs and chickens, are thrown by them into the boiling red lake during an eruption, to appease the wrath of the aggressive dame, and thus cause the rivers of lava to cease flowing on their destructive course.

These berries grow in clusters on low bushes right on the very brink of the brimstone beds, and are so numerous that a bushel may be easily gathered in half an hour. In appearance they somewhat resemble a cranberry, and the flavor is pleasantly suggestive of grapes.

Space forbids more than passing mention of many other fruit trees of the tropics—such as the *avocado*, or alligator pear, tasting like our ordinary salad; the curious pineapple, with its cactuslike leaves; the mandarin orange, glowing brightly against its deep-green foliage; the *cherimoya*, or custard apple; the lime, the lemon, and the Japanese *loquat*—though they are all of great beauty and extended usefulness.

WAR AND CIVILIZATION.

By W. D. LE SUEUR.

THE events of the last few months in the field of international politics, though they have been of a sufficiently disquieting character, have served at the same time to reveal the profound antagonism between the idea of war and the developed moral consciousness of the age. Rumors of war have filled the air, and, in more than one highly civilized community, popular passions have been roused to a dangerous pitch; yet, in spite of the raging of demagogues and the angry acclaims of the populace, war has not broken out. The sky has been black with thunder clouds, but the storm has not burst. To say that war between civilized nations is henceforth impossible would be to speak with singular rashness, in view of the vast and ever-increasing preparations for war which the most civilized nations have, during the last ten or twenty years, been engaged in making, and in view also of the waves of warlike sentiment which have lately swept over communities that might be supposed to be by instinct and principle most inclined to peace. At the same time it is impossible for those who abhor the thought of war not to derive hope and comfort from the fact that it seems almost impossible even now to bring the dread result about. Jingoes and other light-hearted and light-headed persons may talk as they like; the moral difficulties to-day in the way of a war between any two very advanced countries are

enormous. We do not say they can not be overcome, that the dielectric can not be ruptured by some sudden and enormous rise of potential; but we do say and rejoice to say that the strain will have to be enormous, and the circumstances fateful to the last degree, before such a result is reached.

We freely grant that, looking at the question theoretically, it is very difficult to imagine the complete cessation of war or the complete discontinuance of warlike preparations. De Quincey, in his celebrated essay on War, took the ground first that war could not be abolished, and secondly that it ought not to be abolished. He regarded it, as he tells us, first as "a physical necessity, arising out of man's nature when combined with man's situation," and in the second place as "a moral necessity connected with benefits of compensation, such as continually lurk in evils acknowledged to be such." War *ought* to exist, he further explains, "as a balance to opposite tendencies of a still more evil character, . . . as a counter venom to the taint of some more mortal poison." De Quincey has developed and, as they say in French, "embroidered" this thesis with his usual eloquence; but we can not admit that he has proved it, which after all is the principal thing. After dismissing the idea that wars have frequently had their rise in the most trivial causes, such as quarrels of the boudoir or a king's ill-humor vented in the first place on his foreign minister and by the latter diverted to a neighboring nation, he states that the real causes of war "lie in the system of national competitions; in the common political system to which all individual nations are unavoidably parties, with no internal principle for adjusting the equilibrium of those forces, and no supreme Areopagus, or court of appeal, for deciding disputes." He points out too, what is perfectly true, that war conducted by responsible powers according to recognized rules is better than unregulated conflicts and reprisals along the frontiers of adjoining states; but, unless we are to assume that such unregulated conflicts could not be prevented by the internal police of the respective countries, we can hardly accept this as a valid argument for the necessity of war. In point of fact such conflicts are prevented in this precise manner; and the frontiers of two neighboring civilized states enjoy in time of peace just as much security and tranquillity as the rest of their territories.

More serious is the argument that war necessarily results from the natural rivalries of states. De Quincey speaks of it as "an instinctive *nisus* for redressing the errors of equilibrium in the relative position of nations. Civilities and high-bred courtesies," he adds, "pass and ought to pass between nations; *that* is the graceful drapery which shrouds their natural, fierce, and tigerlike relations to each other. But the glaring eyes, which

express this deep and inalienable ferocity, look out at intervals from below these gorgeous draperies; and sad it is to think that at intervals the acts and the temper suitable to those glaring eyes *must* come forward." That differences of national temperament, differences of institutions, and commercial rivalries do breed animosities is, unfortunately, true; but still the question presents itself: How long will the civilized nations of the world persist in a willingness to slaughter one another for these causes? It is acknowledged on all hands that the character of war has changed greatly for the better in modern times. It still is a matter of killing and of maiming in the endeavor to kill; but, decade by decade, it has to reckon more and more with the spirit of humanity. In this age, when civilized nations fight, they fight because they must or think they must, because overmastering circumstances have driven them to it; but the spirit to do the dreadful deeds which they set out to do is not what it was in past times: they neither hate nor contemn their enemies sufficiently to make war quite a satisfactory pastime. Our essayist talks of the "glaring eyes." Doubtless there is always danger when the eyes glare, for the next thing may be a spring; but the eyes may glare under momentary provocation, when there is no permanent rancor in the heart; and then what woe it would be if a moment's madness should mean the wrapping of a kingdom or a continent in the flames of war!

These are the thoughts which, we believe, are pressing themselves more and more upon the minds and hearts of men in the present day. Our essayist himself tells us that war is "ever amending its modes," and that, though it is a necessary final resort, it is even in that character "constantly retiring farther into the rear." This was written fifty years ago, when as yet arbitration between nations was scarcely known. The question which we may reasonably ask is, how much further war will have to retire into the background without falling into practical desuetude. War, moreover, tends continually to its own extinction, inasmuch as it is continually bringing the principles of international justice into clearer relief, and operating as "a bounty upon the investigation and adjudication of disputed cases." In this way "a comprehensive law of nations will finally be accumulated"; so that "it will become possible to erect a real Areopagus or central congress for all Christendom; not" (the essayist is careful to add, keeping in mind his thesis) "with any commission to suppress wars, but with the purpose and effect of oftentimes healing local or momentary animosities, and of taking away the shadow of dishonor from the act of retiring from war." It is encouraging to think that these words have more point to-day than ever they had before; that the progress of events and the

development of humanitarian feeling have within the last fifty years very greatly increased the difficulties in the way of war, and powerfully inclined nations to regulate their relations with one another on principles of equity. Where is this process to stop? There is evidently a radical contradiction between the appeal to reason and the appeal to force; and if the habit of appealing to reason is gaining strength day by day, can we believe that the nations will go on indefinitely making preparations on the most enormous scale for the other mode of arbitrament? "One thing is clear," says De Quincey, "that when all the causes of war involving manifest injustice are banished by the force of opinion focally converged upon the subject the range of war will be prodigiously circumscribed." It is a great satisfaction to know that things are most distinctly moving in this direction. As a much more recent author, M. Ernest Lavisse, in his admirable little book, entitled A General View of the Political History of Europe, observes: "The ambition of territorial aggrandizement is tempered by a certain modesty. At the present day no sovereign would dare to undertake annexations on pretexts such as Louis XIV gave before attacking Spain in 1667, or Frederick II in 1740 after invading Silesia. If Poland's existence, miserable as it was, had been prolonged a few decades, her destruction would perhaps have been impossible."

That wars have directly or indirectly resulted in some advantage to the world in past times, it would be vain to deny; and that their rôle of usefulness even between so-called civilized nations is wholly and forever at an end, it would not be safe to assert. This, however, may be said, that if war ensues between two such nations, it is owing not to their civilization in any true sense, but to some lack in the civilization of one or other or both —some predominance of the spirit of greed, some inaccessibility to the dictates of reason, some fault of domestic government by which the crude passions and ignorant prejudices of the multitude or possibly the interested and partial views of a governing class, are allowed undue sway, some national overweeningness, some aberration of public opinion. War in such a case teaches sharp and much-needed lessons; but, unfortunately, it does not invariably advance the cause of justice. It shows where power resides, but does not always indicate the right. It may chasten where chastening was less needed, and exalt the pride of those who already were too insolent. Whatever evil it may destroy, it leaves new-created evil in its path. All we can hope is that, upon the whole, the education of the world may be advanced by the dire experience. We need not, however, laud war on this account, any more than we laud the epidemic which, taking its origin in neglect of sanitary principles, attacks by preference the weakly

constitutions in the community, and, having passed, leaves the average of constitutional vigor somewhat higher than before. If we do not laud war, still less should we laud the dispositions that lead to war. Yet this is precisely the fatal error into which many fall: because some of the ulterior effects of war have in certain cases been beneficial, they hold themselves justified in cultivating and encouraging the war spirit. As well might we deliberately heap up garbage for the purpose of breeding a second epidemic because a preceding one had, from a sanitary point of view, produced some good results. The lesson to be learned from epidemics is how to avoid them, not how to bring them on; and, so with war, the question should ever be how to prevent it for the future, how to destroy the *nidus* in which its seeds germinate.

As we have already hinted, the eloquent De Quincey is far, in our opinion, from having proved his contention that war ought to exist, even if we had power to abolish it. He is not the only writer, however, who puts forward this view. "It is a question," says M. Lavisse, in the work to which we have already referred, "whether universal peace is a desirable object, whether it would not diminish the original energy of national genius, whether the best way to serve humanity would be to create human banality, whether new virtues would arise to replace the virtues of war. It is also a question whether universal and perpetual peace is not radically and *naturally* impossible." The doubts expressed by so competent a writer, and one commanding so wide a survey of the historical field, are certainly deserving of all consideration. What strikes us, however, at the first glance is, that plausible as these generalities may be, they have nothing whatever to do in determining the course of events, or in guiding the policy of a single state. Even could it be proved, much more conclusively than has ever been done yet, that war, with all its drawbacks, was favorable to the progress of the world, no nation would *on that account* burden itself with a war budget. The sole reason why nations tax themselves for the maintenance of armaments is because they consider it necessary to their safety to do so. There is not a power in Europe to-day that would not gladly disband its armies and dismantle its fleets if it were fully persuaded that no prudential reasons existed for keeping them in a condition of efficiency. This, it seems to us, is the broad fact to look at: war may be a school of virtue and may have a thousand other beautiful aspects, but it is not for the promotion of virtue, or the alimentation of poetry and romance, or for any general philanthropic purpose, that the nations of the world arm themselves to the teeth. Their views are of a more practical kind. They dread the injustice and greed of one another; each would feel its existence imperiled if it did not provide in ample measure to resist foreign aggression. If war

is the blessing and benefit that some pretend, the logical thing would be to have war for war's sake, quite independently even of so flimsy a pretext as the Venezuela boundary. Then, by a due course of murder and rapine, we could train our youth to virtue, our army contractors to public spirit and honesty, our newspaper writers to modesty and truthfulness, our legislators to a lofty patriotism, and everybody else to a correspondingly high moral level.

War is the avenger of the *faults* of civilization; but, like other avengers, it is too furious to be discriminating. It may sweep a certain amount of "rubbish to the void," but none the less are the brain and brawn and heart of noble manhood crushed under its relentless feet. It may destroy some of "the cankers of a calm world and a long peace," but it blights at the same time the fairest promise of the age, and extinguishes its brightest hopes. There are virtues developed in the battlefield and the bivouac; but how much of virtue perishes in the slaughter of the battle or moans itself away within hospital walls! It is easy to talk glibly of the benefits of war; but if we seriously consider the havoc it makes in homes and hearts, and the horrible sufferings of every kind that it entails, not to mention the check that it gives to peaceful industry, and the burdens that it imposes on future generations, the benefits in question will appear very unsubstantial in comparison.

Concrete examples will, however, serve our purpose here better than any amount of generalizing. Twenty-five years ago there was a great and bloody war—of course the bloodier a war is the more we may expect from it—between France and Germany. We may, therefore, advantageously study the effect of the struggle upon both nations, and as regards one of them, Germany, we have the facts of the case ready to our hand in an article by A. Eubule Evans in the February number of the Contemporary Review. The first result which this writer, who is far from wanting in sympathy with the German people, notices is that their national self-consciousness and susceptibility are greatly increased. They wish now to exclude all foreign words from their language, even from the language of commerce, in which it is a decided advantage to have as many words as possible of world-wide signification. Before the war the French word "billet" was commonly used for a railway ticket; now it is banished in favor of "Fahrkarte." Before the war there was a disposition to abandon the crabbed German character, and use the open Roman print, common to the rest of Europe; to-day that idea, we are informed, is tabooed. "The old letters have become the symbol of patriotism, and no one talks of discarding them." So German eyes must suffer, and additional difficulty must be thrown in the way of the acquisi-

tion of the German language by foreigners, simply that Germans may enjoy a greater sense of separation from—and doubtless of superiority to—the rest of the world. To the natural abruptness of German manners there has been added, we are told, a decided flavor of aggressiveness which was not characteristic of them before the war. National self-assertiveness has become, the writer states, "a positive cult. It is encouraged," he adds, "by the authorities; it is fostered in the schools; perhaps some day it will form a subject for examination."

The most serious injury, however, has been done to the spirit of liberty. Prosecutions for lese majesty are the order of the day, and the charges on which such prosecutions are based are often of the most trivial kind. Editors accused of this crime for their criticism of the Government or the emperor are "treated in many respects like ordinary felons." They are not allowed out on bail before trial, but are kept in confinement, and at trial are brought up in prison dress. "Any adverse criticism of the Kaiser's utterances is a penal offense. Praise or silence—these are the alternatives." And yet, as Mr. Evans very truly observes, there has never perhaps been a monarch whose speeches more loudly challenged criticism. Such, however, is the price, or part of the price, which the German nation is paying for success in a great aggressive war. It is not only in political matters that the utmost restriction of political liberty prevails. "It is the same in everything. There is little possibility of independence in speech or action. The police are always at your elbow; and woe to you if you do not carry out their injunctions to the letter!" He adds: "To live in Germany always seems to me like a return to the nursery. . . . In fine, generally speaking, the aspect of affairs in modern Germany is by no means exhilarating. It seems to me that it may be summed up in a few words: an enormous increase of power and influence abroad, but at home less comfort, less liberty, less happiness."

It did not fall within the scope of the article from which we have been quoting to refer to any of the political events that have marked the interval between the termination of the Franco-German War and the present time; but an instructive commentary on the spirit which warfare, particularly successful warfare, breeds is afforded by the fact that five years after the close of the war the victorious and all-powerful German nation was only prevented by the peremptory prohibition of the Czar of Russia from falling again, without a shadow of justification, upon its weakened adversary, with the avowed intention of so crushing and maiming it, by further loss of population and territory, as to reduce it definitively to the rank of a second-class power. We have said "without a shadow of justification"; but to the mili-

tary mind, and to a people intoxicated with military glory, it was justification enough that their defeated enemy was showing great powers of recuperation. The moral sense of Europe was shocked by this cynicism; but if war is such a beautiful thing as some pretend, and so useful an instrument of Divine Providence, how can we be sure that any war is to be condemned?

If we look at France, can we say that she has profited greatly by the ordeal passed through? An indirect result of the war was a change in her form of government, and considering the fundamental instability of the Napoleonic *régime* this must be counted a permanent advantage. The change had to come, and it was well that it was hastened. If, however, we look for signs of moral or intellectual improvement in the nation at large it is doubtful whether we shall find them. The politics of the country has been honeycombed by corruption; so that more than once it has seemed as if the people, sick of the misdeeds of their legislators and full of contempt for the whole parliamentary system, were on the point of sending the Third Republic packing after the first two, and making another desperate experiment with some "savior of society." If we consult the literature of the day, we certainly see no signs of moral advance. If such up-to-date writers as Paul Hervieu and "Gyp" may be trusted, the higher walks of society could hardly be more abandoned than they are to greed, luxury, and lust. Education has been making rapid progress, and so has crime; while the financial burdens of the state go on increasing at a portentous rate. The nation has doubtless learned from its calamities some lessons of self-restraint; and, as we have said, it has escaped from an essentially bad form of government, but it is difficult to assign any other beneficial results to the terrible scourging it received in the war with Germany. Comparing it, however, with the latter country, it seems to have suffered almost less from its defeats than the latter from its victories.

Crossing the Channel, we see a country which, though not unaffected by the increase of the military spirit which has marked the last quarter of a century, illustrates in a broad way the advantages as regards individual liberty and civilization in general which flow from at least a relative aversion to war. For forty years the British nation has waged no war in Europe, nor any war abroad that has at all seriously taxed its strength; and the methods of the government and the habits of the people are consequently more in harmony with a *régime* of peace and industry than is the case in any of the continental nations. Interferences with individual liberty which on the Continent would be taken as a matter of course would in England be resented as acts of tyranny. One of the chief marks of the industrial, as opposed to the military, *régime*, according to Herbert Spencer, is that under it

the civil authority is chiefly known to the individual citizen as the protector of his rights, not as the director of his actions. This is the case in Great Britain to a remarkable extent. Authority there puts on no airs; it has duties to perform, and demands respect for itself in the performance of them; but it does not pretend to occupy a position of superiority over the people at large. What it does it does in their interest and by their warrant, and the only feeling, therefore, which a magistrate or other officer of the law has in that country is that he is co-operating with others for the general weal. In the courts lawyers may sometimes try to browbeat witnesses; but lawyers are *not* invested with authority, and the appeal of the witness in that case lies to the judge, who, as a rule, will not allow that kind of thing to go too far. In Victor Hugo's Misérables there is an interview between a young man of good social position (Marius) and a subordinate police officer, whose assistance the former has been obliged to invoke against a band of criminals. The petty potentate questions the young man very brusquely, and, finding him quite self-possessed and free from fear, compliments him in the following terms: "You speak like a brave and honest man. Courage does not fear crime, and honesty does not dread authority." An Englishman would have felt like knocking the fellow down for his impertinence and taking all risks. The preposterous idea that a citizen seeking the assistance of a functionary in a matter which the functionary is paid for attending to, should stand in any dread of him! But in countries infected with the military spirit civil authority can hardly help putting on the airs of absolute power.

The history of England may, however, be appealed to in support of the principle that individual liberty waxes and wanes according to the greater or less predominance of militarism. Wars conducted abroad, though they have an important reactive effect at home, do not affect domestic administration as wars carried on within the nation itself. The Norman conquest secured for England, if we except the struggles which occurred after the death of Henry I, a long period of comparative internal peace, toward the close of which parliamentary institutions began to take form and substance. Then followed the Wars of the Roses, which led to a decided increase in monarchical absolutism. But again peace came to the help of liberty; and, in the words of Bagehot which Mr. Spencer quotes, "the slavish Parliament of Henry VIII grew into the murmuring Parliament of Queen Elizabeth, the mutinous Parliament of James I, and the rebellious Parliament of Charles I." For over a century after the Commonwealth, liberty and social order continued to gain ground; but again came a period of reaction brought on by the incessant wars waged by England between 1775 and 1815. So severely were the resources of the nation

strained that the military point of view dominated every other, the Government regarding the people, as has been said, in no other light than as "a taxable and soldier-yielding mass." "While," as Mr. Spencer observes, "the militant part of the community had greatly developed, the industrial part had approached toward the condition of a permanent commissariat. By conscription and the press gangs was carried to a relatively vast extent that sacrifice of the citizen in life and liberty which war entails. . . . Irresponsible agents of the executive were empowered to suppress public meetings and seize their leaders, death being the punishment for those who did not disperse when ordered. Libraries and newsrooms could not be opened without license; and it was penal to lend books without permission. Booksellers dared not publish books by obnoxious authors." * It was during this period that the poets Coleridge and Wordsworth found themselves being tracked by a detective in their walks through the country lanes of Somersetshire, the meditative manner and earnest discourse of the two bards doubtless impressing the intelligent minion of the law with the idea that they must be hatching revolutionary schemes. With the re-establishment of peace on a secure foundation liberty revived; and domestic legislation began to assume a distinctly humane and beneficent character. The penal code was greatly ameliorated, the long list of capital offenses being reduced till there remained but one, and the pillory and imprisonment for debt being abolished. Penalties and disabilities for religious dissent were gradually removed; the franchise was enlarged; municipal reform was inaugurated; the corn laws were abolished; free trade was introduced, liberty of the press established, and the police system of the kingdom greatly improved. These are the works and triumphs of civilization, and they flowed in almost unbroken streams as soon as the nation had recovered from the effects of its prodigious military efforts.

But, another change is now in progress, induced partly by the extreme tension of the Continental situation, and partly by circumstances peculiar to the present time. The apostle James in his day gave a very summary answer to the question, "Whence come wars and fightings among you?" "Come they not hence," he said, "even of your lusts that war in your members?" A recent article in the London Spectator, under the title of The New Form of International Greed, might almost be taken for a commentary on this text. What the journal in question points out is that while in past times the greed of nations was for territory without special regard to its wealth-producing properties, the greed to-day is for actual wealth and for such territory as is ex-

* Principles of Sociology, vol. ii, p. 626.

pected to yield wealth. "As the root of socialism," it says, "is the thirst of the poor for more physical comfort, better food, better lodging, and more leisure, so the root of international jealousy is the thirst for a larger national fortune. The peoples are eagerly scanning the roads to wealth, and find them, not in industry and reduced taxation, but in tropical possessions, in foreign trade, in the immense businesses based on 'concessions'—that is, in reality, upon mining rights, state contracts, and monopolies of all descriptions. In particular the thirst for gold in its concrete and tangible shape has broken out everywhere, almost as strongly as it broke out in the sixteenth century among Spaniards, Portuguese, and Elizabethan Englishmen." It happens that most of the gold-bearing territories are in English hands, and this, the Spectator thinks, accounts for a great deal of the jealousy with which England is regarded. Here we have, most unfortunately, a special and somewhat ignoble cause for the intensifying of the military spirit in the present day; and how to find a remedy for it is an extremely difficult question. The Spectator advises the English people "to remember that prosperity and success involve certain duties, one of which is to suffer others to be prosperous too, and another to abstain from boasting."

Here the baffling question arises, Can a whole people be advised? Individuals may listen to counsel; but, when it comes to a whole people, one wonders whether anything but experience, with a touch of natural selection thrown in, can teach. It certainly is the case that, *if* the nations would abate their greed and boastfulness, the danger of war would be much reduced, and the terrible burdens which it imposes be greatly alleviated. Patriotism is a good thing, but we fear that much evil is wrought in its name. It is not patriotism to disparage rival nations, or to seek to secure for one's own unjust advantages. Not unadvisedly did old Dr. Johnson, in a phrase now sadly trite, but perhaps never more apt than in the present day, describe patriotism as "the last refuge of a scoundrel." The doctor had doubtless seen more than one specimen of the loud-mouthed breed who shout for the flag and execrate the foreigner, but who would cheat their country at the first turn if they could get the chance. Patriotism, let us tell our children, if we can not get wider audience, is not a matter either of shouting or reviling, it is a matter of disinterestedly serving the country in which our lot is cast, and in which we enjoy the benefits of citizenship. That is the whole of it, but that is much. It may mean laying down our life; it may mean sacrificing our property; it may mean incurring unpopularity through fighting against wickedness in high places or in low places, and struggling for the good name of our country against those who are bringing it into discredit; at all times it means a

faithful performance of the public duty that lies nearest at hand. "The old flag and an appropriation!" is the motto of a certain well-known brand of patriot; but the true patriot not only drops the "appropriation," but makes his reserves about the flag, which may or may not be associated with a righteous cause. The motto which commands his allegiance is, "My country's honor and well-being!" No less a cause than this is worthy of a good citizen's devotion.

Much is being said at the present time about the importance of cultivating patriotism in the public schools, and, not only so, but of preparing the scholars—the boys at least—by military drill for more quickly transforming themselves into soldiers at a future day. In several States of the Union this system is already in force, and there are ceremonial occasions when the flag is saluted, and so forth. Whether all this is for the best may well be doubted. It is difficult to put a gun into a boy's hand and drill him without creating in his mind a desire to kill somebody. Do we or do we not wish to cultivate this spirit in the rising generation? There is no doubt that the ease or difficulty with which a country is led into war depends very largely upon the dispositions of its population. If their thoughts run on war; if they have been accustomed by a semi-military training in the schools to make little of the horrors of war, and perhaps less of its crimes; if they have taken in the idea which continually haunts the military mind that might makes right, there can be no doubt that, in a given contingency, when a spirit of moderation and justice would smooth over an international difficulty, the voice of such a people will be given for war. They will perhaps then learn a needed lesson; but how foolish for people to set to work with their eyes open to produce the dispositions which lead to such a result! Admitting that the nation which had sedulously cultivated bellicose sentiments in its youth, and at great expense put itself in a condition to back up any aggressive or offensive policy on which it might enter, should conquer in an ensuing war, would that be a thing to be proud of, if the war were unjust? If the blood of Abel "cried from the ground," what of the blood of a hundred thousand, or two hundred thousand, or five hundred thousand Abels needlessly slain—slain that a restless military class might have the means of winning distinction in their chosen profession; slain that army and navy contractors should enrich themselves by a nation's calamities; slain that vulgar and ignorant passions might find vent in bloody action?

There is no subject to-day on which public opinion needs more to be enlightened than on the connection between peace and liberty on the one hand, and between war and tyranny on the other. Mr. Spencer's chapters on this subject, in the volume we have

referred to, well repay perusal and reperusal. It may truly be said that we do not as yet know in the full sense what liberty is, and it may be added that, if the military spirit resumes possession of the world, as it is threatening to do, we are not likely to know. In a well-written article on this subject by Mr. A. B. Ronne, in a preceding number (June, 1895) of this magazine, it was pointed out that, since the close of the war of secession, there have been many manifestations of a more arbitrary spirit in the Government of this country than the people had previously been accustomed to, and that the idea of "regulation" was altogether too much in the air. There is one thing to be said on this point, and that is, that the misuse of liberty leads to regulation. Were there only one nation in the world, that nation might fall under a tyranny if its citizens could not use their liberties aright. If peace helps liberty, liberty should take counsel of justice and moderation, so that Peace be not ashamed of her work. We must learn to curb in peace those lusts that lead to war. A nation whose own internal condition was wholly satisfactory could by no possibility be dragged into a war of aggression, and would run extremely little risk of having to wage a war of defense. In such a nation the feelings that prompt to war would be wholly lacking.

We began this article by referring to the fact that very serious impediments, which we were glad to believe were largely of a moral kind, seemed to stand in the way of war between civilized nations in the present day; and, even as we have been writing, news comes that the principle of arbitration is more and more commending itself to the common sense and common humanity of mankind. There seems at the present moment every probability that, as between England and the United States, that principle will ere long be adopted as a fixed and, as it were, constitutional mode of settling international differences; and if once this step is taken the effect on the world at large will be very marked. Governments that have not advanced to the same point will seem to occupy altogether an inferior position; and it will not be long before their subjects begin to inquire with no little urgency why they can not enter into similar treaties and, by so doing, put an end to the terrible tension and hideous waste of human labor which the present situation involves. An article in the February number of the new international magazine Cosmopolis—a happy omen, we take it, of the better times to come—reviews in a very interesting and encouraging manner the progress which the principle of arbitration has made in the world. Since 1872, we learn—that is, since the Alabama arbitration—"nearly forty cases have been settled by arbitration; the large majority of these refer to differences between American republics, or of European states with American republics. The United States referred ten dis-

putes to arbitration and England eight, and of these four were between England and the United States." The writer, W. J. Gennadius, quotes two very apposite declarations, one by General Grant, and one by that experienced and sagacious statesman, the late Earl Russell. Grant's words are, "Though I have been trained as a soldier, and have participated in many battles, there never was a time when, in my opinion, some way could not have been found to prevent the drawing of the sword." And Earl Russell's: "On looking at the wars which have been carried on during the last century, and examining into the causes of them, I do not see one in which, if there had been proper temper between the parties, the questions in dispute might not have been settled without recourse to arms." These declarations are worth reflecting on. The proviso introduced by Earl Russell is particularly significant: "*If there had been proper temper between the parties.*" That is what is wanted, "proper temper." It resolves itself thus into a question of national righteousness. The cynic may laugh at the conclusion; but those who are not cynics will venture to believe that the problem is not hopeless.

THE X RAYS.

By JOHN TROWBRIDGE,
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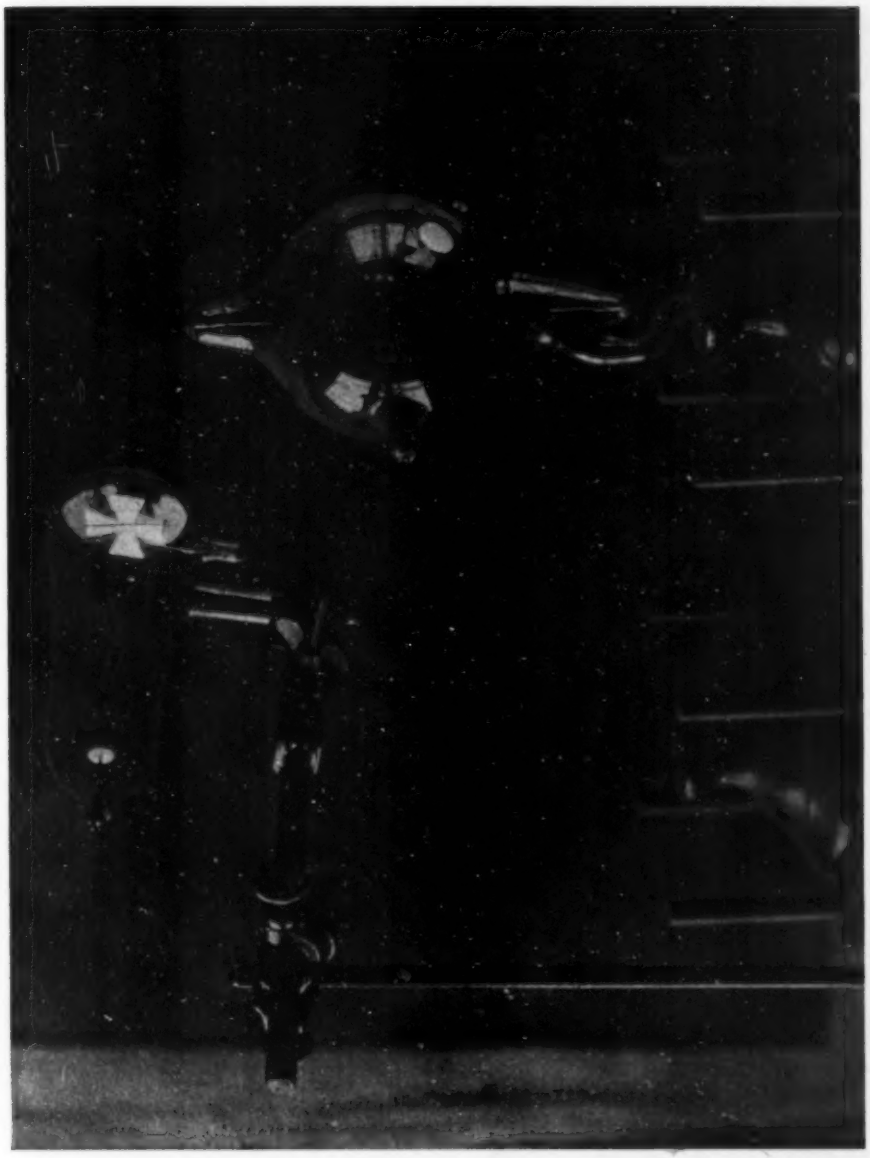
SINCE the publication of Hertz's paper on the penetration of thin sheets of metal, notably aluminum, by the cathode rays, interest in the remarkable phenomena investigated first by Prof. Crookes has been reawakened to a marked degree; and most physicists during the past five years have regarded the subject of cathode rays as the most important one in electricity. In 1893 Lenard succeeded, by means of a Crookes tube provided with a small aluminum window, in detecting the cathode rays outside the tube in the air space of an ordinary room. He used paper disks covered with a very fluorescent substance, which became luminous when the cathode rays struck them; and he also succeeded in showing photographic effects of the rays. Now Röntgen, by the use of ordinary dry plates and without the use of an aluminum window, has taken photographs through wood and through the human hand by means of what he terms the X rays, which he supposes are excited either in the glass walls of the Crookes tube or in the media outside the tube by means of the cathode rays.

We see, therefore, that the literature of the subject must be

sought in the papers of Crookes, Hertz, Lenard, and Röntgen; and the interest in the mysterious manifestations of these invisible rays is twofold: first, in regard to the possible application of the phenomena to surgery, since the rays show a specific absorption, passing more easily through the flesh than through bones or glass or metallic particles; and, secondly, in relation to the questions whether we are dealing here with radiant matter shot forth from the negative pole or cathode or with longitudinal waves of electricity.

Let us first examine the possibility of the practical application of the cathode photography to surgery. The term cathode is applied to the zinc pole or negative pole of an ordinary battery. It is that terminal of an electrical machine which glows least in the dark when the machine is excited. It is the shortest carbon in the ordinary street electric lamp. The positive carbon or anode burns away twice as fast as the negative carbon or cathode. If the electric light is formed in a high vacuum by means of a great electro-motive force, we no longer have a voltaic arc or a spark; instead of this the exhausted vessel is filled with a feeble luminosity, and a beam of bluish rays is seen to stream from the negative terminal or cathode. When these rays strike the glass walls of the vessel they excite a strong fluorescence. If the glass contains an oxide of uranium this fluorescence is yellow; if it contains an oxide of copper it is green. Röntgen supposes that this fluorescence excited by the cathode rays is connected in some way with the formation of what he terms the X rays. Now, a photograph of the bones in the hand, for instance, can be obtained by placing a sensitive plate in an ordinary photographic plate-holder. Resting the hand on the undrawn slide in the daylight, with the palm of the hand outward and toward the cathode, and about six inches away from it, the bones of the hand are thus brought in the nearest possible position to the sensitive plate. At the time of the present writing, the breast and the abdomen of the human body present too great thickness for successful photographs, and the attempts to obtain representations of the cavity in which the brain is situated have been failures, since the rays do not show any marked difference in fleshy tissues. Nothing can be obtained in these attempts to photograph the brain but a contour of the cavity in which it is situated, and possibly a shadowy representation of a bullet which might be imbedded in the head. The method of obtaining a successful photograph of the hand shows the present limitations of the method. In order to obtain a fairly sharp shadow of a bone or of a shot, it should not be more than an inch away from the sensitive plate. The term shadow, however, is somewhat misleading. The photograph of the hand by the X rays is entirely different from one produced by resting the hand

in a similar position to that above described against an uncovered sensitive plate in a dark room and then lighting a match. By the last method we should obtain a true shadow of the hand, the flesh would throw as dense a shadow as the bones, and the latter could



CROOKES TUBES.

not be detected in the general blackness. In the cathode photograph, on the other hand, a difference in absorptive power is shown: the flesh looks like a hazy film around the skeleton, and even the medulla cavities can be made out, and the varying thick-

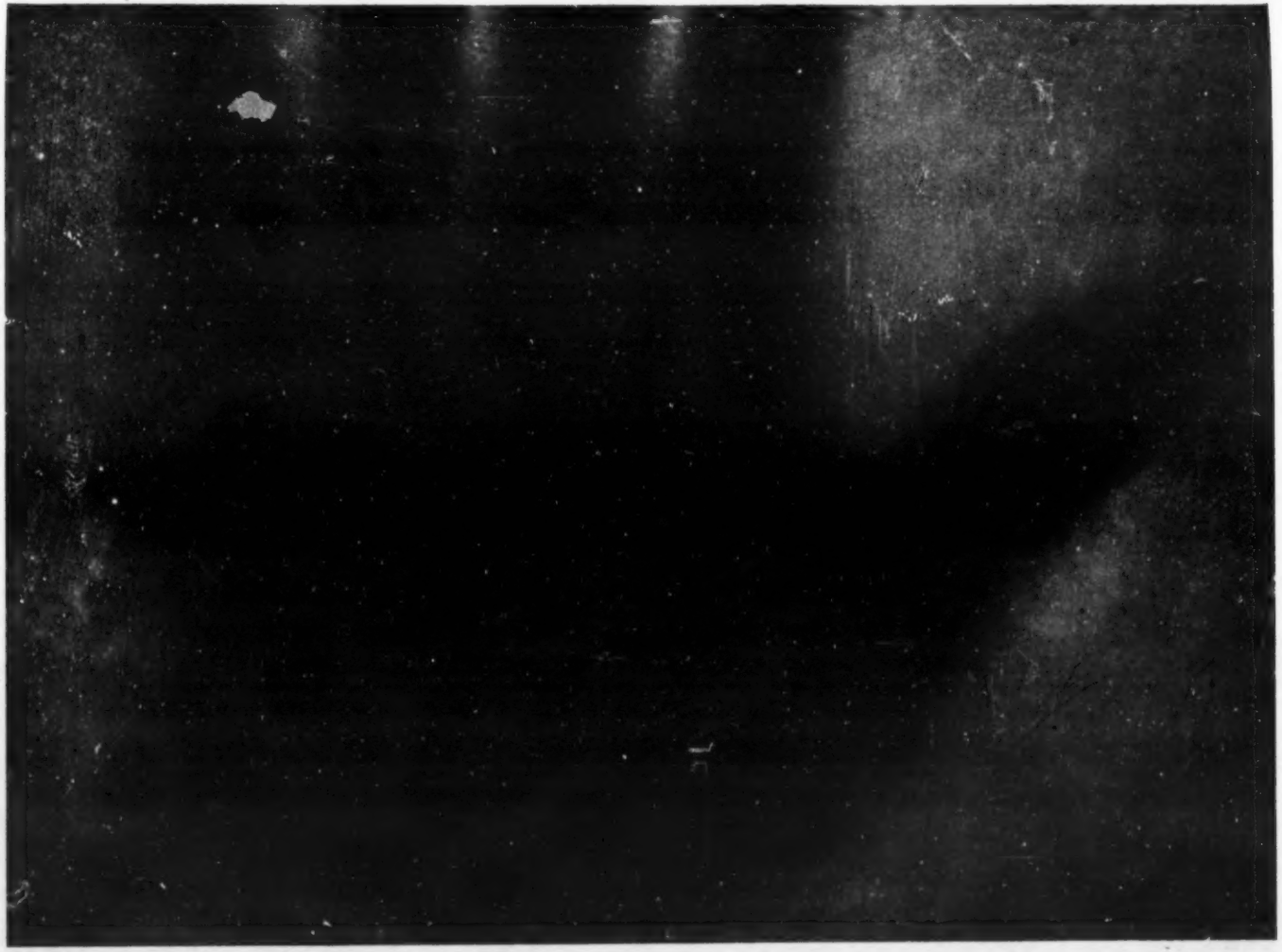
ness of the bones is more or less shown. This specific absorption is of great scientific interest as well as of practical importance.

Now, these X rays will penetrate several inches of wood, with varying amount of absorption, but they are almost entirely cut off by glass as thick as a window pane. They pass through thin layers of aluminum, even layers as thick as a silver ten-cent piece, while the silver coin almost entirely intercepts them.

It therefore immediately occurs to one, Why not return to Lenard's tube, provide a Crookes tube with an aluminum window, and thus save the great absorption of the glass walls of the tube? There are certain practical difficulties in the way. The aluminum must be very thin. Lenard used a window which was about one eight-thousandth of an inch thick, and it was necessarily very small, in order to stand the atmospheric pressure. An aluminum window one eighth of an inch thick, or as thick as a ten-cent piece, would absorb nearly as much as the glass walls of the present forms of Crookes tubes, which are not more than one sixtieth of an inch thick. Glass vessels seem at present to be more practical than any composite form, in which aluminum is glued to a glass-supporting vessel: first, because it can be blown very thin, and in a shape strong enough to withstand the atmospheric pressure; secondly, because the occluded air can be more effectively driven off the inner walls of the vessels by heating it while it is being exhausted than it can be expelled from a vessel of any other material.

To obtain successful photographs, the exhaustion of the air must be pushed to a high degree; and this is also interesting from the scientific point of view. Moreover, a high electro-motive force is necessary. Pictures can be taken in less than one minute of the skeleton of the human hand by means of high vacua tubes excited by high electro-motive force. Even in this bare recital of the present limits of the application of the X rays to photography, we perceive great possibilities in the application of the method to the surgery of the human extremities. There is no doubt that small foreign bodies, like shot and pieces of glass, can be detected in the fleshy tissues of the hand. Certain accessible regions of the body, like the mouth, can possibly be examined by placing a sensitive film inside the mouth and the cathode outside of the cheek; and it does not seem improbable that a suitable cathode vessel can be inserted into certain abdominal regions and a photograph be obtained by placing a sensitive plate on the outside of the body. By employing two cathodes, at the proper distance apart, stereoscopic representations of the bones can be obtained, and an estimate formed of the position of foreign bodies.

Let us now turn to some of the interesting scientific questions



HAND AFTER AN EXPOSURE OF ONE MINUTE.

which have arisen in regard to this apparently new manifestation of the cathode rays. In the first place, they are apparently not refracted by paraffine, vulcanite, or wood, or by any substance which is penetrated by them. To test this, I employed a double-convex lens of wood and also a double-concave lens of the same material. I placed two copper rings in the concavity of the double-concave lens of wood, and also a similar copper ring outside the lens at the same height from the sensitive plate, as one of the rings which rested on the wood of the lens. I also placed a ring on the double-convex lens, and employed two cathodes to obtain two shadows from different positions. The thickness of the wooden lenses varied from half an inch to three quarters of an inch. The images obtained through the wood of the lenses were not distorted or changed in figure in any way by the wood, and therefore no refraction could be observed by this method. On account of the quick diffusibility of the rays, no accurate method of determining a possible index of refraction seems possible. If the photographic effect is due to longitudinal waves in the ether, and if these waves travel with great velocity, no refraction would probably be observed. Maxwell's electro-magnetic theory of light supposes that only transverse waves are set up in the ether, and no longitudinal waves exist. On the other hand, Helmholtz's electro-magnetic theory of light postulates longitudinal waves as well as transverse waves. The longitudinal waves travel with an infinite velocity. Is it therefore possible that the X waves are the longitudinal waves of Helmholtz's theory? Our apparent inability to refract the rays lends color to this hypothesis. Röntgen, in the preliminary account of his experiments, intimates that the phenomena may be due to longitudinal waves, and in a late article in the Annalen der Physik und Chemie, by Jaumann, entitled Longitudinal Light, Maxwell's electro-magnetic equations are modified so as to embrace the phenomenon of cathode rays; and the author shows that even Maxwell's theory can, under certain conditions, give a longitudinal wave.

The cathode rays can be deflected by a magnet, and it is said that the X rays can not. It must be borne in mind, however, that when the cathode rays are widely divergent it is difficult to deflect them by a magnet; the stream density, so to speak, is too feeble. The X rays, therefore, may be only cathode rays modified by passing through the glass vessel; and the stream of rays may be of too feeble a character to be influenced by a magnet—that is, they may be still cathode rays. The want of refractive power and the want of magnetic action have not been fully established. Crookes early showed that two cathode beams sent out from two cathodes placed beside each other, repelled each other, as if they consisted of streams of negatively electrified molecules. If the two beams

were of the nature of electrical currents, they ought, being of the same sign, to attract each other. This experiment seems to point to an electrostatic nature of the cathode rays. The electrostatic lines of force go out from a charged conductor at right angles to the surface of the conductor. I have had constructed a Crookes tube with two parallel terminals of aluminum. The fluorescence in the walls of the vessel, when it was exhausted, showed that the cathode rays went out from every element of the cathode at right angles to it. By bending it into an arc of a circle the cathode beams traveled over the surface of the vessel, forming zones of light the centers of which were in the bent wire. Is it not possible that by the electrostatic action the few molecules of air left in the high vacua are shot off with great velocity and bombard the walls of the vessel, thus giving rise to the fluorescent light, and also giving rise to an agitation of the molecules of matter outside the vessel? This may be called the molecular view of the phenomenon. I confess it is difficult to see why the molecular agitation is stopped by a thin sheet of glass and not by an inch of wood. It is certain that a few molecules must be left in the high vacua, for the cathode rays can not be formed in a perfect vacuum.

It is also true that it is useless to attempt to obtain photographs in any reasonable time from tubes which do not show a strongly marked cathode beam, or from tubes which on reversing the electric current through them do not show a marked difference between the light at the cathode and that at the anode. In poorly exhausted tubes one can perceive a faint appearance of a cathode beam, which is lost at a short distance from the cathode, as if the molecules which are shot off meet with such a crowd of more slowly moving ones that their energy is soon lost, and the cathode beam is quickly diffused like a beam of sunlight passing into milk and water. Thus the beam of cathode or X rays emerging from the glass vessel into the air is soon no longer conical in form. The sides of the cone of rays are no longer straight; they are curved, as if the generatrix of the cone were a curved line instead of a straight line, and the beam is soon lost in a turbid medium. One can imagine a stream of projectiles being similarly dispersed in striving to pass into a region of sluggishly moving shot. This molecular view of the phenomenon seems at first sight to be a more tangible one than the longitudinal wave theory. It is possible, too, that the impact of the molecules on the aluminum window of Lenard, or on the glass sides of the vessel, may serve to start ripples, so to speak, in the ether, which are propagated with the velocity of light.

The Röntgen phenomenon seems to be a manifestation of cathode rays brought to light and endowed with great practical

interest by its application to dry-plate photography. When we return to the classical investigation of Lenard mentioned in the beginning of this article, we are impressed by an apparently crucial

RÖNTGEN PICTURE OF A HAND AFTER LENGTHENED EXPOSURE.
From The New York Medical Journal.

experiment which he describes in regard to the existence of an ether. He caused the cathode beam to pass out of his high vacua through an aluminum window into another tube about three feet

long, which had been exhausted to such a high degree that no electrical discharge would pass through it. It seemed, therefore, to have an infinite electrical resistance. No cathode beam could be generated in it; nevertheless, by moving suitable disks of fluorescent matter from point to point in the tube by means of an outer magnet which attracted bits of iron on the disks, Lenard showed that the cathode beam passed through the vacuum. Energy passed into the vacuum and could be detected from point to point. We can conceive of its passing through the ether in the tube by a wave motion, but not by a molecular movement, for there were no molecules to move. The molecular bombardment must have stopped at the aluminum window, and the resulting energy may have been propagated by ripples in the ether. This experiment of Lenard seems to me the most interesting one in the subject of cathode rays. The greatest mystery, however, which envelops the subject is the action of the X rays on bodies charged with electricity. When the rays fall on, for instance, a charged pith ball, the charge disappears. A positive as well as a negative charge is dispelled by the X rays. The energy of the medium about the pith ball is changed to a marked degree, and in this phenomenon we seem to be brought closer to a wave theory in a medium than to a molecular theory of movement of matter.

ACCLIMATIZATION.

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SECOND PAPER.

WHAT is the first effect of a tropical climate upon the human body and its functions?* The respiration becomes more rapid for a time, although it soon tends toward the normal;† the pulse beats more quickly;‡ the appetite is stimulated;* and a surexcitation of the kidneys‖ and the sexual organs ensues;△ the individual as a rule becomes thinner;◊ the liver tends to increase in size, which is perhaps the cause of a certain sallowness of skin;‡ and in females menstruation is often

* This general subject is somewhat technically discussed in Revue d'Anthropologie, new series, ii, p. 135.

† Jousset, *op. cit.*, p. 160. Also Bulletin de la Société de Géographie de Paris, 1878, p. 427.

‡ Ibid., p. 197. * Ibid., pp. 208, 211. ‖ Ibid., p. 221. △ Ibid., 229.

◊ Ibid., p. 139. Healthy Europeans in the tropics are lighter in weight than the same class at home (Archiv für pathologische Anatomie, etc., cxix, p. 254).

‡ Hirsch, *op. cit.*, iii, p. 388; *cf.* Peschel, Races of Man, p. 92.

disturbed, the age of puberty being sooner reached.* A very important change, which has not perhaps been fully investigated as yet, is a temporary rise of temperature, which often lasts for some time after the individual leaves the tropics.† Sir Humphry Davy was the first to note, on a voyage to Ceylon, that the temperature of travelers tended to rise in this way,‡ and Dr. Guegnen confirms his conclusions, although he shows that the rise is less than had been supposed.* Dr. Maurel concludes that it varies from 0·3° to 0·5°.‖ Observations on Europeans between Khartoum and the equator showed that for those who had been there less than two years the average was 99·5°, or nearly a degree above the normal. Those who had been there longer than four years exhibited a lower temperature of 99·1°, still a half degree over the average in Europe.△

It is not impossible that these delicate variations of temperature may bear some relation to the racial pathological predispositions which we have noted, as well as to the liability of the newcomer in the tropics to contract fevers and other zymotic diseases from which the natives and the fully acclimated whites are immune.◊ Darwin indirectly hinted at such a solution many years ago, and suggested at the same time a study of the relation of the complexion to immunity from fevers. But no one appears to have followed it up.‡ The recent development of the science of hydrotherapeutics certainly points to this conclusion. Several observers have already noted a permanent difference in the normal mouth temperature of the different races. Glogner has shown that the temperature of the Malay is slightly lower than that of Europeans,‡ the brown skin radiating heat more freely.‡ The Mongolian race more nearly approaches the European than does the negro, whose norm is considerably lower.** Dr. Felkin†† gives observations to show that the average mouth temperature of six

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* This well-known fact is clearly shown by statistics in Revue d'Anthropologie, second series, v, p. 373.

† Jousset, *op. cit.*, pp. 201, 207, 259, 391.

‡ Proceedings of the Royal Society, London, 1814, civ, 1825. Other references in Bulletin de la Société d'Anthropologie, Paris, 1884, p. 374.

* Archives de Médecine navale, January, 1878.

‖ Bulletin de la Société d'Anthropologie, 1884, pp. 375 *et seq.*

△ Proceedings of the British Association for the Advancement of Science, 1889, p. 787.

◊ The true creole, for example, is immune from yellow fever.

‡ Descent of Man, i, p. 233 *et seq.*

‡ Archiv für pathologische Anatomie und Physiologie und für klinische Medicin, cxvi, p. 540.

‡ Ibid., cxix, p. 256. Contains many tables of results.

** Bulletin de la Société d'Anthropologie, Paris, 1884, p. 380. Jousset affirms the same quite independently, *op. cit.*, p. 383.

†† Proceedings of the British Association for the Advancement of Science, 1889, p. 787.

hundred negroes between the equator and 10° north latitude was 97·8° F., the European normal being 98·6°. Higher than either were the Soudanese, whose average was 99°. In the European coming to the tropics, therefore, the temporary rise of body temperature increases still more the difference between his own and the indigenous normal in most cases. It has, indeed, been suggested that this is the cause of malarial fever in the tropics, but the matter has never been fully investigated, especially in its relation to other zymotic diseases.

Among animals the connection between minute variations of body temperature and the liability to contract diseases due to micro-organisms is well established. A fowl, whose normal temperature is considerably above that of the horse, the dog, or the rabbit, is immune from splenic fever, to which these other animals are liable; and yet Pasteur, by reducing its blood heat to their level, by immersing its legs in cold water, was able successfully to inoculate it with the anthrax bacillus.* And other fowls were cured of the fever so contracted by artificially raising their temperature to a point at which the bacillus could no longer thrive. For the same reason tuberculosis does not flourish in frogs or other cold-blooded animals, unless their blood temperature is sufficiently raised to permit of its germination. It is too early to assert that the same law will apply to the "traumatic" diseases of the tropics; but one point is certain, that newcomers in those regions are particularly liable to zymotic diseases during that period when their temperature is most above the native normal; and that immunity from attack, or at least a more benign form of the disorder, often comes with that fall in temperature which is perhaps the surest sign of true acclimatization. Finally, it will be noted that even when this temperature falls once more to the European normal, it is still higher than that of the natives. And if there were any truth in this theory, the perfect accommodation to the environment which the natives of the tropics enjoy, would be attained only when the normal temperature of the European had been reduced to their level. But the persistence of physiological ethnic traits is a well-known fact; the Hindu to-day, despite his long sojourn in the tropics, has a temperature merely reduced to his own racial normal—to reduce it still further to the level of the negro would require ages of time.†

Acclimatization in this physiological sense, of a gradual approach and approximation to the normal type of the natives, must of necessity be an exceedingly slow process, involving many generations of men. Yet in every respect except of temperature it

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* Sutton, Evolution and Disease. London, 1890, p. 253.

† Jousset, *op. cit.*, p. 382.

appears that the first effects of a sojourn in the tropics is to induce symptoms which point toward the peculiarities of the native type. Thus the increase in the size of the liver indicates the operation of those causes which have finally made the negro's liver normally larger than that of the European.* The only present difficulty is that an unusual strain is suddenly put upon the various organs in this process of gradual adaptation which is often too severe; as, for example, the high mortality among Europeans from derangement of the liver, such as hepatitis, bilious fever, abscesses, and the like, which indicates that some physiological change has taken place which has entailed an excessive demand upon the activities of this organ. Similarly the extreme liability of the negro to diseases of the lungs in the temperate zone may be due to his lack of physiological accommodation to those circumstances which have in hundreds of generations produced the European type. To expect that man can in a single generation compass the ends which Nature takes an age to perform is the height of folly. The exact nature of the physiological processes induced by the tropics is, however, so imperfectly known that we must in general rely upon concrete experience for our further conclusions.

RESULTS OF HYGIENE.—Hygiene and sanitation have accomplished wonderful results in assisting the individual to withstand those immediate effects of climatic change which, as we have said, are so often fatal.† The yearly loss at one time in India was eighty for each regiment of one thousand men. In 1856 it had been reduced to sixty-nine; from 1870 to 1879 it ranged about sixty-two; and in 1888 the annual loss was only fifty, including deaths and invaliding.‡ The loss in Cochin-China per regiment

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* This is suggested by Bastian in Zeitschrift für Ethnologie, Part I, 1869; *vide* also J. R. Mayer, Die Mechanik der Wärme, p. 97 (Stuttgart, 1867), and Jousset, p. 108. The physiological characteristics of the negro are well described by Jousset as follows: A weakly developed chest (p. 85), less respiratory power and lung capacity (p. 88), more rapid pulse (p. 95), diminished muscular tension (p. 100), lower temperature (p. 107), less perspiration (p. 111), and a tendency toward slimness (p. 139). The lessened vitality and power of endurance is also to be noted (p. 144). Pruner Bey confirms these results in his studies of the vascular system of the negro. *Vide* also Quatrefages, *op. cit.*, p. 407. Drs. Baxter and Gould, in their studies on our soldiers during the civil war, confirm this fully. (Investigations in the Military and Anthropological Statistics of American Soldiers, Cambridge, 1869; and Medical Statistics of the Provost-Marshal General's Bureau.)

† Discussed by Hunt, *op. cit.*, p. 140, and by Dr. Montano, *op. cit.*, p. 8 *et seq.*; by Davidson, *op. cit.*, for India; and by Dr. Farr, in Journal of the Royal Statistical Society, xxiv, p. 472. *Vide* also, for statistical information, ibid., iv, p. 1; viii, pp. 77, 193; ix, p. 157; x, p. 100; xiv, p. 109; xv, p. 100. Tables of the comparative mortality of British troops in various countries are conveniently given in Revue d'Anthropologie, new series, iv, p. 175. Macculloch, Statistical Report on the Sickness and Mortality of Troops, London, 1840, gives a vast amount of information.

‡ Scottish Geographical Magazine, vii, p. 647.

was one hundred and fifteen in 1861; the actual deaths have now been reduced to twenty-two, although a much higher figure would be needed to include invaliding. The terrific annual loss of one hundred and forty-eight per thousand in Senegal from 1832 to 1837 is now reduced to about seventy-three. In this last case, however, one hundred and fifty per thousand are returned for sickness every year.* A large proportion of these would undoubtedly die if not removed immediately. One may indeed be hopeful from such results that, with further advance in the science of prevention, these figures may be yet further reduced. The system of vacations,† of strict regulation of diet, the avoidance of excessive fatigue and exposure, and especially of all forms of agricultural labor, and the extension of the hill-station system, will do much in this respect; so that it is conceded by most candid observers that, with few exceptions, such as Cochin-China and the coast of Africa, robust individuals by great care stand a fair chance of good health in the tropics. Nevertheless, this should never be allowed to conceal the real fact that the English to-day are no nearer true acclimatization in India than they were in 1840. To tolerate a climate is one thing, to become independent of it is quite a different matter. The securing of a permanent footing in the tropics depends upon factors of a totally different nature.

FERTILITY.—Passing now from the consideration of the individual to that of the race, the keynote of the matter rests in the much-controverted question of the influence of change of climate upon fertility. For, however well the individual may be enabled, by artificial means or otherwise, to exist, the race will never accommodate itself permanently unless the birth-rate exceeds the death-rate.‡ Here we must first carefully eliminate the effects of ethnic crosses with natives of the tropics; for a fatal mistake of many observers has been the neglect to distinguish the possible sterility induced by intermixtures of race from that caused by a change of climate and of life conditions; or statements of one have been accepted by tyros as equivalent to the other. It has been confidently asserted for so many years that sterility of the white race ensues after three generations in the tropics that it has become a household word in anthropology.*

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* Revue d'Anthropologie, third series, iv, p. 346.

† In Cochin-China one year in three is the allowance. The improvement in Senegal is largely due to the brief sojourn of the troops, who are relieved at short intervals. This system now prevails also in India, in sharp contrast to the old practice of keeping the soldiers there for long terms, in the hope of forcing acclimatization in that way.

‡ *Vide* remarks of Prof. Virchow on this point in Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, p. 202.

* Many examples of acceptance of this theory of infertility will be found in popular works. Pearson (National Life and Character, p. 89) bases his whole argument upon it

The result of comparative study of the lower forms of life is suggestive in this connection.* With plants and animals a sudden change of habitat will often produce a temporary sterility, which disappears only after a series of chance variations. The chrysanthemum remained infertile for sixty years after its introduction into France from China, so that continued importation of the seed was necessary. Finally, in 1852 a few plants developed seeds; and from these others were raised, until to-day the species is self-sustaining in Europe. A similar experience with corn at Sierra Leone, with the goose at Bogotá, and European poultry in America, is instanced by De Quatrefages.† His rather optimistic argument with regard to the future of acclimatization is based, indeed, upon the study of animals and plants, rather than of man. He reasons by analogy that if fertility becomes re-established by spontaneous variation in this sphere, it may be likewise affirmed to be true for man, thus giving countenance to the view that climatic changes do indeed produce infertility.

Despite the authorities who hold on general principles that sterility in man follows—or at least that it ought to follow—a sudden change of climate, direct proof for it is very hard to find. Broca has indeed affirmed that the Mamelukes in Egypt became infertile for that reason;‡ but in his case, as in all others, no attempt is made to eliminate a number of other factors. Jousset declares, on the contrary, that no direct effect upon fecundity can be traced to climate.* Dr. Fritsche concedes that, although sterility may result, there is as yet no direct evidence to prove it.‖ The difficulty, it will be observed, is to eliminate the effects of crossing with the natives, or else of marriage with newly arrived immigrants. A physician of twenty-seven years' experience in the Dutch Indies has never known a European family to keep its blood unmixed in this way for the necessary period of three generations. Only one example of pure isolation is known, in the island of Kisser, and sterility there is by no means certain.△ Ste-

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Prof. Virchow even asserts it to be true in Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, p. 213. It was at the bottom of the exploded theory of Knox and Brace with respect to the decreasing birth-rate in America. *Cf.* Mémoires de la Société d'Anthropologie, iii, p. 25.

* Discussed by Wallace in Encyclopædia Britannica. Also for forest trees in Kirchhoff's Forschungen, iii, p. 28 *et seq.*

† *Op. cit.*, p. 225. Many other examples are given. Wallace (*op. cit.*) gives the interesting case of the acclimatization of wheat north of the Great Wall by the Emperor of China.

‡ Human Hybridity. *Cf.* the case of the creoles in the island of St. Louis, cited in Revue d'Anthropologie, new series, v, p. 30 *et seq.*

* *Op. cit.*, p. 231. The superior health of women, due to less exposure, has already been noted.

‖ Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, p. 258.

△ Ibid., 1886, p. 89.

rility from climate as a single cause in this part of the world, then, can neither be affirmed nor denied, from utter lack of evidence.*

On the contrary, a number of examples of continued fertility might be given. Brace affirms the Jews to be fertile even in Cochin-China,† and Joest says that Europeans in Africa often bear children.‡ The Spanish women in Guayaquil, on the authority of Dr. Spruce, in a climate where the temperature is seldom below 83° F., and in the complete absence of intermarriage with the natives, are the finest along the coast; and the white population is exceedingly prolific.* The experience of Algeria, so far at least as heat is concerned, seems to bear out the same conclusion, the birth-rate being higher even than in France.‖ De Quatrefages, despite his inference of a temporary infertility, certainly takes a hopeful view for the other French colonies.^ Some remarkable examples of fecundity, indeed, are not lacking. Some years ago, an English woman, never out of India, not even taking a vacation in the hills, died at the age of ninety-seven, leaving eighteen children.◊ Tilt, however, denies that the English in general can ever become acclimated there.‡ Sterility, of course, while most important, is not the only element in the acclimatization of the race. Even if we could affirm that sterility did not result, the perpetuation of a people in the tropics would not necessarily follow; for the mother may seldom survive childbirth, as in the East Indies and on the Zambesi,‡ or the children may seldom survive,‡ the age of six being often a critical period.** But these facts have no connection with sterility or the reverse, although they may produce the same negative result in the end. The final word upon this subject awaits more carefully sifted evidence than any we now possess.

Comparative Aptitudes of European Nations.—The future political destiny of Africa is not unlikely to be dominated by a remarkable fact—namely, the severe handicap against which the Teutonic stock, and especially the Anglo-Saxon branch, struggles in the attempt permanently to colonize the tropics. And

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* Verhandlungen der Berliner Gesellschaft für Anthropologie, 1886, p. 92.

† Wallace, *op. cit.*

‡ Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, p. 473.

* Wallace, *op. cit.*

‖ Levasseur, La Population Française, iii, p. 432.

^ *Op. cit.*, p. 231.

◊ Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, p. 379.

‡ Health in India for British Women.

‡ Peschel, Wallace, Quatrefages.

‡ Jousset, *op. cit.*, p. 314. *Cf.* Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, p. 258, on Egypt.

** Wallace, *op. cit.*

this is peculiarly unfortunate, since these are the very peoples who find population pressing most severely upon the soil at home.* The Latin nations, of course, are the ones who lay most stress upon this comparative disability of their rivals; but in justice to the French, it must be added that they have generally recognized that the Spaniards and Italians possess as great an advantage over them as they in turn do over the Germans.† The experience of Algeria affords a good illustration of this point. The year 1854 marks the first excess of births over deaths in this colony; and the following table shows the relative disabilities of the Europeans for 1855–'56:‡

	Births *pro mille.*	Deaths *pro mille.*
Spaniards	46	30
Maltese	44	30
Italians	39	28
French	41	43
Germans	31	56

Dr. Ricoux# gives the following death rates per thousand for children under one year: Spaniards, 180; Maltese, 178; Italians, 194; French, 225·2; and Germans, 273. This disability of the Germans is confessed by all their most able and candid authorities.‖ All writers, even in France, acknowledge that the Mediterranean natives possess a peculiar aptitude in this respect.△

* Levasseur, La Population Française, iii, p. 432.

† Revue d'Anthropologie, second series, viii, p. 190.

‡ Bulletin de la Société d'Anthropologie, 1886, p. 269; *cf.* L'Anthropologie, vi, p. 120. The small number of Germans present weakens the force of the evidence somewhat.

Annales de Demographie, vi, p. 14. *Cf.* Quatrefages, *op. cit.*, p. 230, and Bordier, Colonization, p. 184. The only north Europeans ever successful are the Dutch in South Africa and in the East Indies.

‖ Ratzel, Anthropo-Geographie, i, p. 304; Virchow, Fritsche, and Joest in Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, pp. 211, 474, etc. It will have been noted that nearly all references in German fall within the years 1885–'87. The question drifted into politics—out of the hands of scientists into those of pamphleteers. *Vide* Max Nordau, Rabies Africana, in Asiatic Quarterly Review, second series, ii, p. 76; and G. A. Fischer, Mehr Licht im dunkeln Welttheil, Berlin, 1886. A blue-book on the subject was promised (Verhandlungen der Berliner Gesellschaft, 1886, p. 87), but the attention of the Colonial Society was for some reason diverted. Tropical hygiene was fully discussed, but the broader scientific aspect of the matter was neglected (Verhandlungen, 1889, p. 732). As late as 1890 no definite government report had been issued except Mähly's work. The Germans apparently do not dare to handle it without gloves, and their views are unique in their optimism (Kohlstock in Science, 1891, p. 3; and Finckelnburg in Handbuch der Staatswissenschaft).

△ Ratzel, *loc. cit.*; Bulletin of the American Geographical Society, 1883, No. 2; Jousset, p. 292; Montano, pp. 444, 446; Felkin, in Scottish Geographical Magazine, ii, p. 52, and in British Association for the Advancement of Science, 1886, p. 730; Levasseur, *op. cit.*, ii, p. 431; and Bordier, Colonization, pp. 185, 493.

Moreover, the French nation is further divided against itself. That the Provençals—the offshoots of the Mediterranean branch of the Aryan stock—succeed better than the people of the Paris basin in the tropics is generally conceded;* and the bulk of French emigration to-day comes from the Rhone Valley, Corsica, and Provence.† This makes the fact still more curious that these same Provençals endured the hardships of Napoleon's Moscow campaign far better than their comrades from Normandy and Champagne.‡ Can it, indeed, be due to an admixture of Semitic blood, as Wallace suggests?

This disability of the Anglo-Saxon stock does not seem to indicate any less vitality, but rather the reverse.* The Crimean War apparently showed that the English possessed a peculiar advantage over the French in their ability to recover speedily from severe wounds.‖ In fact, the mortality after capital operations in English hospitals is only about half that among the French.^ We have already observed that primitive peoples, while showing a relative immunity from septic disorders, still remain peculiarly sensitive to all changes of climate.◊ And the case of the Anglo-Saxon stock is analogous to it in this respect, having a higher recuperative power conjoined to disability in becoming acclimatized.‡ This is undoubtedly in part due to national habits, but it also appears to be rooted in race. In peopling the new lands of the earth, therefore, we observe a curious complication; for it is precisely those people who need the colonies most, and who are bending all their political energies to that end, who labor under the severest disabilities. A popular opinion is abroad that Africa is to be dominated by the English and German nations.‡ If there be any virtue in prediction, it would rather appear that their activities will be less successful as soon as the pioneering stage

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* Quatrefages, *op. cit.*, p. 230; Jousset, p. 192; Montano, p. 449; and Levasseur, ii, p. 431.

† L'Anthropologie, v, p. 253.

‡ Bulletin de la Société d'Anthropologie, i, p. 326; and Revue d'Anthropologie, new series, i, p. 76.

* Dr. Beddoe, Races of Britain, p. 224, gives some exceedingly interesting observations upon this point.

‖ Revue d'Anthropologie, new series, i, p. 76 *et seq.*

^ Topinard, Elements, p. 412.

◊ The stupendous failure of the project of colonizing the State of Durango in Mexico with negroes from the United States is a case in point. *Vide* letter in Boston Transcript, dated Mexico, August 11, 1895. Dr. Brinton, in Races and Peoples, p. 40, gives some valuable references upon this point.

‡ Dr. Montano, p. 447; Revue d'Anthropologie, second series, v, 74: "The Anglo-Saxon race is least apt of all in accommodating itself to warm climates." This fact is reluctantly admitted by Dr. Felkin and other English authorities as well.

‡ *Vide* typical editorial in Boston Herald, May 2, 1895.

gives way to the necessity for actual colonists, who with their families are to live, labor, and propagate in the new lands.

Summarizing the views of authorities upon this subject, the almost universal opinion seems to be that true colonization in the tropics by the white race is impossible.* The only writers who express themselves favorably are Crawford,† whose hopes for India have certainly not been fulfilled; Armand ‡ and Rattray,* Dr. Livingstone and Bishop Hannington,‖ and the physicians assembled at the Medical Congress at Berlin in 1890,^ with the Society for the Advancement of Medical Science in the Dutch Indian Settlements.◊ All these authorities may now be classed as antiquated, except the last, and moreover the first one represents that nation which is notoriously unsuccessful in acclimatization. The opinion of the Dutch physicians who have been fairly successful may be met by as good testimony from their own number on the opposite side.

Authorities in favor of the view that complete acclimatization of Europeans in the tropics is impossible might be multiplied indefinitely. Among the earlier writers of this opinion are Knox,‡ Prichard,‡ Dr. Hunt,‡ and Sir Ranald Martin.** The best German authority concedes it, including Virchow, Fritsche, Joest, Fischer,†† with Buchner ‡‡ and Hirsch.*** The French, who have studied it more scientifically than any other nation, hold to this opinion with no exception.‖‖ Jousset declares that recruiting stations never effect a permanent recovery, the only remedy being to leave the tropics altogether.^^ This opinion is also shared by many of the Dutch, who dissent from the favorable views of

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* The most definite as well as the latest expression of expert opinion fully agrees with this. *Vide* Proceedings of the International Geographical Congress at London, 1895.

† Transactions of the Ethnological Society, London, new series, i, p. 89.

‡ Traité de Climatologie, Paris, 1873. * Jousset, p. 426.

‖ Scottish Geographical Magazine, vii, 647.

^ Proceedings of the Royal Geographical Society, January, 1891, p. 30.

◊ Referred to in the Proceedings of the Seventh International Congress of Demography and Hygiene, London, xi, p. 170.

‡ Quatrefages, p. 229. ‡ Jousset, p. 426.

‡ *Loc. cit.*, p. 135; other opinions of early writers are here given as well.

** Encyclopædia Britannica, Acclimatization.

†† Scottish Geographical Magazine, vii, p. 647, and Verhandlungen der Berliner Gesellschaft für Anthropologie, 1885, pp. 210, 257, 474. Prof. Virchow distinguishes between malaria and climate, which is generally a distinction without a difference in the tropics.

‡‡ Correspondenzblatt, xviii, p. 17.

*** Verhandlungen, 1886, p. 164.

‖‖ Dr. Rey, *op. cit.*; Boudin, Bulletin de la Société d'Anthropologie, 1864, pp. 780 and 828; Legoyt, Jousset, p. 426; Bertillon, Bulletin de la Société d'Anthropologie, 1864, pp. 519 and 578; Bordier, Colonization scientifique, pp. 184, 397, 472; and Revue d'Anthropologie, third series, i, pp. 667, 672.

^^ Jousset, p. 434.

their countrymen already quoted.* The English writers of this opinion include Ravenstein,† Sir William Moore,‡ and Tilt.* Dr. Felkin alone holds to a slightly more favorable view of colonization in Africa, although he qualifies it by requiring an unlimited amount of time; and he finds comfort in the thought that Central Africa is no worse than India. He finally concedes, however, that in this latter colony the hill districts are the only ones where the English can remain in health.‖ For some years the hopes for Africa as a field for colonization were based upon the altitude of the inland plateau. But expert opinion on this seems to show that, with the sole exception of Matabeleland, the country is impossible for European colonists.△ And even Mr. Stanley declares that cautious pioneering is all that can be expected for the future in the Congo basin—that colonization was never anticipated at all.◊ In the face of such testimony there can be but one conclusion: to urge the emigration of women, children, or of any save those in the most robust health to the tropics may not be to murder in the first degree, but it should be classed, to put it mildly, as incitement to it.

It must not be understood that by this is meant that the white man can not live in the tropics. Hygienic precautions and great care can often render a prolonged sojourn in these regions perfectly harmless. But, as Mr. Wallace observes, the Englishman who can spend a summer in Rome in safety only by sleeping in a tower and by never venturing forth at night, can not be truly said to be acclimated. A colony can never approximate even to the civilization of Europe until it can abolish or assimilate the native servile population; and yet, one of the many things which are expressly forbidden to all colonists in the tropics is agricultural labor. It would be a waste of energy to give citations to prove this, for every work on acclimatization insists upon the necessity of this precaution. Let it be understood, then, that a colonial policy in the tropics means a perma-

* Dr. Van der Burg in Transactions of the Seventh International Congress of Demography and Hygiene, p. 170. After all precautions have been taken, "such a settlement ought to be continually supported by new supplies from the European continent for many, possibly for hundreds of years, in order to have a chance of healthy existence."

† Proceedings of the Royal Geographical Society, January, 1891, p. 31, and Proceeding of the British Association for the Advancement of Science, 1894.

‡ Edinburgh Medical Journal, xxxi, part ii, p. 852.

* Transactions of the Seventh International Congress of Demography and Hygiene.

‖ Proceedings of the British Association for the Advancement of Science, 1886, p. 729.

△ Proceedings of the Royal Geographical Society, January, 1891, p. 31, and Transactions of the Seventh International Congress of Demography and Hygiene, p. 178.

◊ Proceedings of the International Geographical Congress, London, 1895. Since this was written new and important evidence to the same end is given in the Scottish Geographical Magazine, xi, p. 512.

nent servile native population, which is manifestly inconsistent with political independence, or with any approach to republican institutions.

Such being our conclusions from a comparison of authorities, what shall we say about the broader question of original racial acclimatization? And what policy, if any, should be modeled upon the theories with regard to the way in which this undisputed operation once took place—for, as we have said, the substantial unity of the human race followed by extensive migrations is an accepted fact. Even in the absence of direct proof, to deny it would be to neglect all the evidence for the same phenomenon among plants and animals so ably set forth by Wallace, Agassiz, Drude, and other writers. Fortunately, however, the researches of ethnologists to-day are continually bringing new evidence to show that such widespread migration has indeed taken place. Two radically different policies are advocated by the adherents of one or the other of the two opposing factions in biological theory. For accommodation to climatic conditions may take place either by variation and natural selection or by habitual adaptation transmitted by inheritance.* Weissmann,† Wallace, Quatrefages,‡ and apparently Dr. Brinton,* rely upon natural selection, which they assert, directly or by inference, takes place in the following way: A large body of men (plants or animals) is transported to the new habitat at once—the larger the number the better—from which by elimination a few fortunate variations survive. Thus, after a long time, and enormous sacrifice of life, a new type, immune to some degree, becomes established. All that the state need do, therefore, is to keep up the supply of immigrants long enough, and leave the climate to do the rest.‖

What state policy may we adopt if we hold to the biological theory of adaptation and heredity? This school includes Virchow and Buchner,^ who firmly defended it at the Natural Science Congress at Strasburg, and by Jousset.◊ Their policy would be to imitate the operations of natural ethnic migrations; they would rely upon the utilization of the natural aptitudes of various nationalities, which we have mentioned—perhaps themselves the fruit of ages of sojourn in certain climates—until finally a great drifting movement toward the equator would take

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* Discussed by Wallace in Encyclopædia Britannica.

† Correspondenzblatt der deutschen Gesellschaft für Anthropologie, xviii, 1887, p. 18.

‡ *Op. cit.* * *Op. cit.*, p. 283, seems to follow De Quatrefages.

‖ This would be the policy outlined by Dr. Van der Burg, quoted in note *ante*.

^ Correspondenzblatt, 1887, p. 18.

◊ *Op. cit.*, p. 245—outlined in his general argument. *Vide* note *ante*.

place.* In other words, the peoples of the Mediterranean basin, learning of their aptitude for a southward migration, would perhaps move to Algeria, displacing the people of the Soudan and the Semitic stocks toward the equator. To fill the place thus left vacant, the people of northern France slowly drift to the Rhone Valley and Provence for a generation or two, and their place is taken by Germans and Belgians.

That this is a tendency at the present time can not be doubted.† Each generation adapting itself quietly would produce succeeding ones with an inherited immunity. Unfortunately, this most reasonable let-alone policy has two fatal objections: in the first place, it requires a policy of noninterference; and, more potent still, it absolutely neglects the political factor. To suppose that France would quietly allow her people to be dispossessed by Germans, even though she aided her colonial policy thereby, or that Germany would quietly leave Africa to her Gallic neighbor, is not to be supposed for a moment. Nevertheless, it will be probably the only policy which will finally produce a new immune type in the regions of the equator. Of course, England is by fate condemned to follow the first policy we have outlined. France, indeed, is the only one of the European states which extends over the two contrasted European climates; a large measure of her success is probably due to that fact; while all the nations north of the Alps must traverse her territory or that of Italy on the way to these newly discovered lands. Great political results are therefore not impossible, if the prognosis we have indicated prove to be correct. At all events, enough has perhaps been said to show that great problems for science remain to be solved before the statesman can safely proceed to people those tropical regions of the earth so lately apportioned among European states.

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* This view is expressed by Ravenstein (Proceedings of the Royal Geographical Society, 1891, p. 35 *et seq.*) and by Dr. Felkin (British Association for the Advancement of Science, 1886, p. 730), who do not, however, seem to appreciate the biological analogies of their mode of treatment.

† Map of foreigners in France in Bulletin de l'Institut international de statisque, iii trois liv., 1888, p. 36; this fact is noticeably prominent. The destination of French emigrants is given in L'Anthropologie, v, p. 253. *Vide* also Transactions of the International Congress of Demography and Hygiene, p. 131 *et seq.*

‡ Other and more technical articles upon the subject have been referred to in footnotes, such as Archives de Médecine navale, Bulletin de la Société de l'Acclimatement de Paris, Archiv für pathologische Anatomie und Physiologie, etc. Maps of the distribution of certain diseases will be found in Gerland's Atlas der Völkerkunde and in the works of Drs. Chervin, Felkin, Lombard, and Sormani.

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THE SAVAGE ORIGIN OF TATTOOING.

BY PROF. CESARE LOMBROSO.

I HAVE been told that the fashion of tattooing the arm exists among women of prominence in London society. The taste for this style is not a good indication of the refinement and delicacy of the English ladies: first, it indicates an inferior sensitiveness, for one has to be obtuse to pain to submit to this wholly savage operation without any other object than the gratification of vanity; and it is contrary to progress, for all exaggerations of dress are atavistic. Simplicity in ornamentation and clothing and uniformity are an advance gained during these last centuries by the virile sex, by man, and constitute a superiority in him over woman, who has to spend for dress an enormous amount of time and money, without gaining any real advantage, even to her beauty. But it is not desirable that so inordinate an accession to ornamentation as tattooing would be should be adopted; for an observation I have made on more than 5,000 criminals has demonstrated to me that this custom is held in too great honor among them. Thus, while out of 2,739 soldiers I have found tattoo marks only among 1·2 per cent, always limited to the arms and the breast; among 5,348 criminals, 667 were tattooed, or ten per cent of the adults and 3·9 per cent of the minors. Baer recently observed tattooing among two per cent of German criminals and 9·5 per cent of soldiers (*Der Verbrecher*, 1893).

CHARACTERISTICS OF CRIMINAL TATTOOING: VENGEANCE.—The minute study of the various signs adopted by malefactors shows us not only that they sometimes have a strange frequency, but often also a special stamp. A criminal whom I studied had on his breast between two poniards the fierce threat *Je jure de me venger* (I swear to avenge myself). He was an old Piedmontese sailor, who had killed and stolen for vengeance. A recidivistic thief wore on his breast the inscription, *Malheur a moi! quelle sera ma fin?* (Woe to me! what will be my end?)—lugubrious words, reminding us of those which Filippe, strangler of public women, had traced on his right arm, long before his con-

demnation, *Né sous une mauvaise étoile* (Born under an evil star).

Malassen, a ferocious assassin, who became in New Caledonia an executioner of convicts (Meyer, *Souvenirs d'un Déporté*), was covered from his feet to his head with grotesque and frightful tattoo marks. On his breast he had drawn a red and black guillotine, with the words in red letters: *J'ai mal commencé, je finirai mal. C'est la fin qui m'attend* (I have begun evil, I shall end evil. That is the end that awaits me). His right arm, which had inflicted death upon so many human beings, bore the terrible device, very appropriate to his hand, *Mort à la chiourme* (Death to the convict).

The famous Neapolitan camorrist Salsano had himself represented in an attitude of bravado. He held a stick in his hand, and was defying a police guard. Under the figure was his sobriquet, *Éventre tout le monde* (disembowel everybody); then came two hearts and keys connected with chains, in allusion to the secrecy of the camorrists.

We see, then, by these few examples, that there is a kind of hieroglyphic writing among criminals, that is not regulated or fixed, but is determined from daily events, and from *argot*, very much as would take place among primitive men. Very often, in fact, the key in the designs signifies the silence of secrecy, and the death's head vengeance. Sometimes the figures are replaced by points, as when a judicial arrest is marked on the arm with seventeen points, which means, according to the criminal, that he intends to strike his enemy that number of times when he falls into his hands.

Another characteristic of criminals, which is also common to them with sailors and savages, is to trace the designs not only on the arms and the breast (the most frequent usage), but on nearly all the parts of the body. I have remarked one hundred tatooed on the arms, breast, and abdomen, five on the hands, three on the fingers, and three on the thigh.

A certain T——, thirty-four years of age, who had passed many years in prison, had not, except on his cheeks and loins, a surface the size of a crown that was not tattooed. On his forehead could be read *Martyr de la Liberté* (Martyr of Liberty); the words being surmounted by a snake eleven centimetres long. On his nose he had a cross, which he had tried to efface with acetic acid.

A Venetian thief, who had served in the Austrian army, had on his right arm a double-headed eagle, and near it the names of his mother and his mistress Louise, with the strange epigraph for a thief: *Louise, chère amante, mon unique consolation* (Louise, dear loved one, my only consolation). Another thief wore on his right arm a bird holding a heart, stars, and an anchor. On the

left arm of a prisoner Lacassagne found the words, *Quand la neige tombera noire, B—— sortira de ma mémoire* (When the snow falls black, B—— will pass out of my memory).

The multiplicity of marks results from the strange liking these curious heroes have of spreading on their body, just after

Fig. 1.

Fig. 2.

the fashion of the American Indians, the adventures of their lives. For example, M—— C——, twenty-seven years old (Fig. 1), who had been condemned at least fifty times for rebellion and assaults

on men and horses, who had traveled, or rather wandered, a vagabond, in Spain and Africa with women whom he left suddenly, wore his whole history written on his skin. One design referred to the ship L'Espérance (No. 1), which was wrecked on the coast of Ireland, and on which he had gone as a sailor. A horse's head (No. 2) represented an animal which he had killed with a knife, from simple caprice, when twelve years old. A helmet (No. 7) indicated a policeman he had tried to kill. A headless woman with a heart on her neck indicated his mistress, who was frivolous (No. 8). The portrait of a brigand referred to a robber chief whom he took for his model (No. 9). A lute (No. 3) recalled a friend, a skillful player of the guitar, with whom he traveled over half of Europe. The star, the evil influence under which he was born (No. 4). The royal crown, "a political souvenir," he said, but rather, we say, his new trade of a spy—that is, the destruction of the kingdom (No. 5).

A French deserter who desired to avenge himself against his chief drew a poniard on his breast (Fig. 2, No. 1), to signify vengeance, and also a serpent. He further drew the ship on which he wished to escape, the epaulets which had been taken away from him, a dancing girl who had been his mistress, and then the sad inscriptions which were truly appropriate to his unhappy life.

Dr. Spoto sent me a study of the tattooing of a criminal who had been under his care. He wore all his sad adventures painted on his arm (see *Archivio di Psichiatria*, June, 1889). He had one hundred and five signs on his body, ten of which represented mistresses, nine hearts, eight flowers or leaves, five animals, twenty-eight names, surnames, or descriptions, and thirty-one poniards or warriors (Fig. 3). On his arm he had a figure of a lady winged and crowned; winged, he said, "because I made her take flight" (he had run away with her); crowned, because she had substituted for the crown of virginity the royal crown in becoming his mistress. She held in her hand a heart and an arrow, signifying her parents, to whom her flight had caused great grief. Beneath her were two branches, which signified that she kept herself always fresh. Two other of his loves explained their sad adventures by holding crumpled roses in their hands. In his hand he had an eagle, representing the ship on which he sailed, and beneath it a heart with three points, referring to the sufferings of Christ, whose birthplace he had visited at Bethlehem. A heart on his arm represented a mistress with whom he lived several years. It was pierced with an arrow, because he had abandoned the woman with two little children, who were represented by two bleeding hearts. Two hearts pierced with swords, on his forearm, represented two mistresses who would not yield to his desires

except when threatened with death. They were connected by a chain with an anchor hanging from it, which signified that the women belonged to a sailor family, and a Greek cross above them

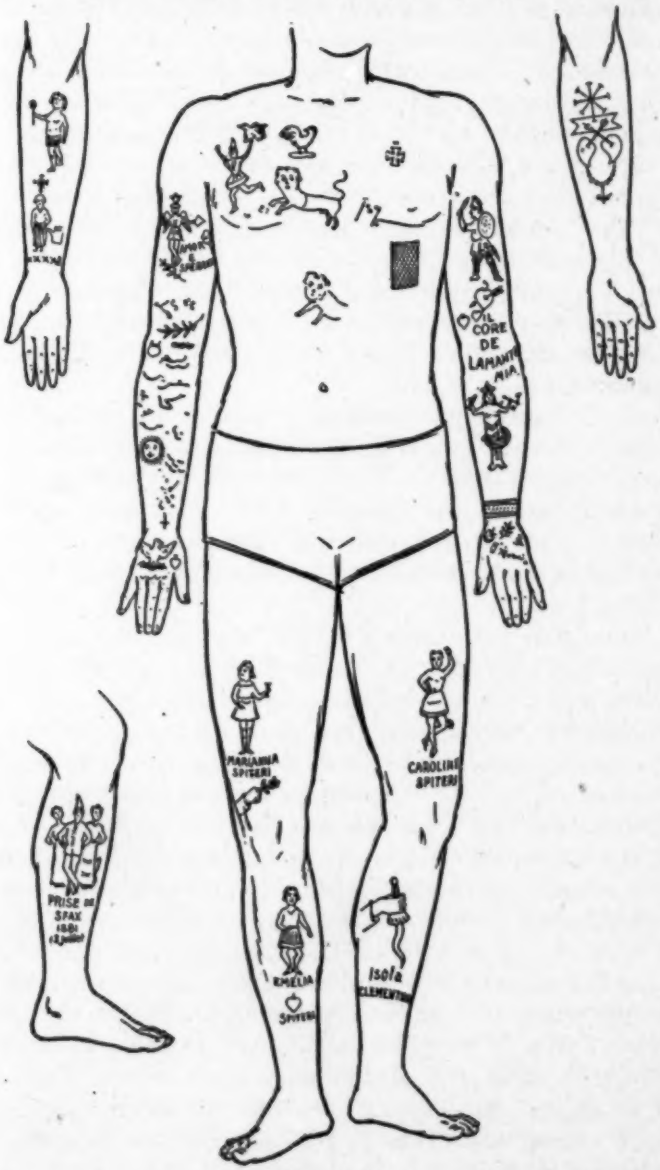

FIG. 3.

indicated that they were Greek. On his breast was a dancing girl carrying a bird, because she bounded like a bird. On his sides were a cock and a lion, the cock corresponding to women who wished to be paid: "When the cock sings, Spiritelli will

pay." The lion meant that he felt as strong as a lion. A smaller lion a few centimetres from this meant that even as among lions the stronger gains the victory over the weaker, so he, the stronger, had overcome those who would play the camorrist with him.

Never, I believe, have we had a more striking proof that tattooing contains real ideographic hieroglyphs which take the place of writing. They might be compared to the inscriptions of the ancient Mexicans and Indians, which, like the tattooings we have described, are the more animated history of individuals. Certainly these tattooings declare more than any official brief to reveal to us the fierce and obscene hearts of these unfortunates.

This multiplicity of figures proves also that criminals, like savages, are very little sensitive to pain. Another fact that characterizes tattooing is precocity. According to Tardieu and Berson, tattooing is never remarked in France before the age of sixteen years (excepting, of course, the cases of ship-boys who have borrowed the custom from sailors); yet we have found, even among the general public, four cases in children of from seven to nine years of age; and of eighty-nine adult criminals, sixty-six displayed tattooings which were made between nine and sixteen years.

Some tattoo marks are used by societies as signals of recognition. In Bavaria and the south of Germany the highway robbers, who are united into a real association, recognize one another by the epigraphic tattoo marks *T. und L.*, meaning *Thal und Land* (valley and country), words which they exchange with one another, each uttering half the phrase, when they meet. Without that they would betray themselves to the police.*

What is the origin of this usage? Religion, which has so much power over peoples and which proves so obstinate in preserving ancient customs, has certainly contributed to maintain it among the more barbarous part of our populations; we see a quasi-official proof of it at Lorette. Those who cultivate a devo-

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* Lacassagne has given us a large number of inscriptions tattooed on French criminals, which all contain criminal or obscene allusions. For example, we read:

Eight times: "Son of misfortune."
Nine times: "No chance."
Three times: "Friends of the contrary."
Four times: "Death to unfaithful women."
Five times: "Vengeance."
Twice: "Son of disgrace."
Twice: "Born under an evil star."
Three times: "Child of joy."
Three times: "The past deceives me."
Once: "The m . . . is worth more than all France."
Once: "Vive la France and fried potatoes! Death to brutes."
Once: "The present torments me; the future frightens me."

tion for a saint believe that by engraving his image on their flesh they will give him a proof, a clear testimony, of their love. We know that the Phœnicians marked the sign of their divinity on their foreheads (Ewald, *Judäischen Alterthum*, iii); in the Marshall Islands they have to ask the permission of the gods to tattoo themselves; and the priests alone in New Zealand perform the office of tattooing (Scherzer). Lubbock adds to this that a woman who does not wear a tattoo mark can not enjoy eternal felicity. The women of Britain tattooed themselves in obedience to religion (Pliny, 33).

The second cause is the spirit of imitation. A Lombard soldier answered me laughingly one day when I rallied him on his having spent a small sum to spoil his arm: "See, monsieur, we are like sheep; and when one of us does anything we all imitate him at once, even if we risk doing ourselves harm."

Love of distinction also has its influence. A thief of the most incorrigible sort, who had six brothers tattooed like himself, implored me, although he was half covered with the oddest tattoo marks, to find him a professional tattooer to complete what might well be styled the embroidery of his skin. "When the tattooing is very curious and spread all over the body," he told me, "it is to us other thieves like the black coat of society with decorations; the more we are tattooed, the more we esteem one another; the more a person is tattooed, the more influence he has over his companions. On the contrary, one who is not tattooed has no influence; he is regarded simply as a good fellow, and is not esteemed by the company."

There are also tattooings inspired by vengeance. Bastrenga, the cruel assassin of T——, had various tattoo marks on his arm (a horse, an anchor, etc.). On the advice of his father, who remonstrated with him that they would make him more easily recognizable, he effaced them. But in 1868 he was arrested anew by the police agents, and when he resisted actively one of them struck him so violently on the head that his eye was permanently hurt. Then, forgetting all prudence, he tattooed himself anew on the right arm; engraved there the fatal date of 1868, and a helmet on the arm that was to strike. "I shall keep this mark many years," he said, "till the time comes when I can satisfy my vengeance." This fact is curious, and illustrates one of the causes that induce savages to tattoo themselves—for registration. It shows, too, that with the born criminals the spirit of revenge prevails over the most ordinary prudence, even when they have been put on their guard. Indolence also counts for something. It explains the number of cases of tattooing which we meet among deserters, prisoners, shepherds, and sailors. Among eighty-nine tattooed persons, I saw seventy-one who had been tattooed

in prison. Inaction is even harder to endure than pain. The influence of vanity is still greater. Those even who have not studied the insane know how powerful this passion is, which is found in all grades of the social scale, and perhaps even in animals, and can lead to the strangest and most foolish actions, from the chevalier who dotes on a little bit of ribbon to the idiot who struts with a straw behind his ear. For this, savages who go entirely naked wear figures on their breasts; for this, our contemporaries who are clothed tattoo that part of the body which is most exposed to sight, especially the forearm, and more frequently the right than the left. An old soldier told me that in 1820 there was not a man in the army especially not a subordinate officer who had not been tattooed to exhibit his courage in supporting pain. The figures of the tattooing vary in New Zealand as do the fashion styles with us.

The spirit of the organization and the spirit of sect contribute to it. I have been led to this conclusion by the examination of some initials which I studied upon incendiaries at Milan, and of certain signs found on young police prisoners at Turin and Naples. Figures of tarantulas and of frogs appear often. I suspect that some groups of camorrists have adopted this new kind of primitive ornamentation to distinguish their sect, as they formerly adopted rings, pins, chains, and different cuts of the beard.

Lastly, the stimulus of the noblest human passions has had its part. It is very natural that the rites of the village, the image of his patron, the recollections of infancy and of the heart's friend should return to the mind of the poor soldier, and be rendered more lively by the tattooed design, when he is struggling against danger, suffering, and privations.

But the primary, chief cause that has spread this custom among us is in my opinion atavism, or that other kind of historical atavism that is called tradition. Tattooing is, in fact, one of the essential characteristics of primitive man, and of men who still live in the savage state.

Some of those pointed bones which are used by modern savages in tattooing themselves have been found in the prehistoric grottoes of Avignac, and in the tombs of ancient Egypt. The Assyrians, according to Lucian, and the Dacians, according to Pliny, covered their whole bodies with figures. The Phœnicians and the Jews traced lines which they called "signs of God" on their foreheads and their hands (Ewald, *Judäischen Alterthum*, ii, p. 7). This usage was so widespread among the Britons that their name (from Brith, painting), like that of Pict and Pictons, seems to have been derived from it. See Cæsar. "These peoples," he says, "trace, with iron, designs on the skin of the youngest chil-

dren, and color their warriors with *Isatis tinctoria* (woad) to render them more terrible on the field of battle."

I do not believe there is a single savage people that does not tattoo more or less. The Payaguns painted their faces in blue on feast days, in triangles and arabesques. The various negro tribes distinguished themselves from one another, especially the tribes of Bambaras, by horizontal or vertical lines traced on the face, the chest, and arms. Kafir warriors have the privilege of decorating their legs with a long azure line, which they are able to make indelible.

In Tahiti the women tattoo only the feet and hands or the ear, tracing collars or bracelets; the men, the whole body, on the hairy skin, on the nose, and the gums; and they often produce inflammations and gangrene, especially on the fingers and the gums. On the Marquesas Islands tattooing is a custom as well as a sacrament. Beginning at the age of fifteen or sixteen years, they put a girdle upon the young people and tattoo their fingers and legs, but always in a sacred place. Women, even princesses, have no right to tattoo anything but their hands and feet; grand personages cover their whole body; and while the designs on the lower part are delicate, those on the face lend it a grotesque and horrible aspect, so that enemies may be struck with fear. At Nukahiva, noble ladies are permitted to wear more numerous tattoo marks than the women of the people.

In Samoa, widows, it seems, tattoo the tongue; men paint the body from the girdle to the knees. The bald heads of old men in the Marquesas Islands may be seen covered with tattoo marks.

The fashionable ladies of Bagdad stained their temples and lips with azure, drew circles and rays of the same color on their legs, painted a blue girdle round their waists, and surrounded each of their breasts with a crown of blue flowers.

Tattooing is practiced in Polynesia at the age of from eleven to thirteen years; and is to these natives what the *toga pretexta* was to young Romans. In the Marquesas Islands it serves as a kind of clothing to the men; they might be mistakenly supposed to be covered with armor. Their face is hidden under the marks. The women here are generally but little tattooed, but coquettes wear the marks on their feet, hands, arms, legs, and forearms—designs so delicate that they might be taken for stockings and gloves in the daytime.

In order to please the women and to be able to find a wife, writes Délisle, the Laotian should be tattooed from the navel to below the calf, all round the thigh; while among the Dyacks the women submit to the operation in order to get husbands. Laotian tattooing is very animated, and represents fantastic ani-

mals, like those on the Buddhist monuments. Among the aborigines of the Marquesas Islands the tattooing exhibits, on the women, designs of every sort: boots, gloves, bows, suns, and lines drawn with remarkable fineness and perfection; on the men, animals—sharks, crabs, lizards, snakes—or plants, or geometrical figures. Here tattooing constitutes real works of art.

Sometimes tattooing and mutilation are combined, as in the famous chiefs' heads of New Zealand, which are overloaded with curved lines, with deep incisions showing as hollows, and with dark colors, with the intervals colored with dotted tattooing that gives the skin a bluish tinge. These curved lines spare no part of the face, and are closer and more numerous, according to the fame of the bearer of them as a warrior, or the antiquity of the origin of his chiefly dignity. The tattooing of the New Zealanders has found an unanticipated use in their relations with Europeans. Thus, the missionaries having bought a tract of land, the facial tattoo patterns of the vendor were drawn at the bottom of the deed, to serve as his signature.

The skins of all the grand chiefs of Guinea are in effect damascened. In New Zealand tattooing forms a sort of coat of arms. The common people are not allowed to practice it; and the chiefs are not permitted to decorate themselves with certain marks till they have accomplished some great enterprise. Toupes, an intelligent New Zealander, who was brought to London a few years ago, insisted upon a photographer taking pains to bring out his tattoo marks well. "Europeans," he said, "write their names with a pen; Toupes writes his this way. No matter," he said also to Dumont d'Urville, "if the Chonqui are more powerful than I, they can not wear the lines on their foreheads, for my family is more illustrious than theirs." The ancient Thracians and the Picts distinguished their chiefs by their special tattooing. The Pagas of Sumatra add a new color every time they have killed an enemy.

Tattooing is the true writing of savages, their first registry of civil condition. Some tattoo marks indicate the obligation of the debtor to serve his creditor for a certain time. The number and nature of objects received are likewise indicated (Krausen, *Ueber die Tatouiren*, 1873).

Nothing is more natural than to see a usage so widespread among savages and prehistoric peoples reappear in classes which, as the deep-sea bottoms retain the same temperature, have preserved the customs and superstitions, even to the hymns, of the primitive peoples, and who have, like them, violent passions, a blunted sensibility, a puerile vanity, long-standing habits of inaction, and very often nudity. There, indeed, among savages, are he principal models of this curious custom.

A last proof of our position is given by the hieroglyphics which we have found to be so frequent among the tattoo marks of criminals, and upon certain inscriptions which undoubtedly go back to an ancient age. A very interesting specimen of this kind is found in a study of tattooing in Portugal by Dr. Peixotto (*Tatouage en Portugal*, 1893), which I reproduce here:

Sator	S A T O R
Arepo	A R E P O
Tenet	T E N E T
Opera	O P E R A
Rotas	R O T A S

As the reader will see, it is the formula of a square, which reproduces the same words, "Sator," "Arepo," "Tenet," "Opera," and "Rotas," on whichever of the four sides we read it, and in whichever vertical or horizontal direction—one of those magical formulas which, according to Kohler (Anthropological Society of Berlin, 1891), were used to drive away fevers from the age of the Romans, as far back probably, at least, as Cato's time.

The influences of atavism and tradition seem to me to be confirmed by the fact that we find the custom of tattooing diffused among classes so tenacious of old traditions as shepherds and peasants.

After this study, it appears to me to be proved that this custom is a completely savage one, which is found only rarely among some persons who have fallen from our honest classes, and which does not prevail extensively except among criminals, with whom it has had a truly strange, almost professional, diffusion; and, as they sometimes say, it performs the service among them of uniforms among our soldiers. To us they serve a psychological purpose, in enabling us to discern the obscurer sides of the criminal's soul, his remarkable vanity, his thirst for vengeance, and his atavistic character, even in his writing.

Hence, when the attempt is made to introduce it into the respectable world, we feel a genuine disgust, if not for those who practice it, for those who suggest it, and who must have something atavistic and savage in their hearts. It is very much, in its way, like returning to the trials by God of the middle ages, to juridical duels—atavistic returns which we can not contemplate without horror.

O Fashion! You are very frivolous; you have caused many complaints against the most beautiful half of the human race! But you have not come to this, and I believe you will not be permitted to come to it.

HYPNOTIC STATES, TRANCE, AND ECSTASY.

By Prof. WILLIAM ROMAINE NEWBOLD.

I SHALL deal in this paper with abnormal states of several types, all of which, in my opinion, may be grouped under the one concept of disordination. The normal consciousness is in all apparently destroyed or displaced, and very often memory of the abnormal states is lacking. Hence we are often compelled to rely upon ambiguous external indications for our knowledge of the patient's condition during the abnormal state, and any attempt to explain it from the psychological point of view is attended with difficulty and open to attack.

In the first place, I must clear away a prolific source of confusion. All the states which I now have occasion to examine are akin to sleep, and many have in addition a superficial resemblance to sleep: the eyes are closed, the countenance is placid, the breathing regular. In others it is less marked: the eyes may be open, fixed, and staring, the body may be rigid and contorted, the face may express intense emotion, movements may occur, and so on. This distinction is purely accidental, and is of no importance from the theoretical point of view. Yet it has become set in our nomenclature, and we can not well get rid of it. For the first group I shall therefore use the generic word "hypnotic," which means simply "sleeplike." The chief characteristics of hypnotic states are: (1) the closed eyes, expressionless face, and relaxed muscles—in general, absence of any spontaneous sign of mental life; (2) the presence of heightened suggestibility. The chief characteristics of the trance states are: (1) spontaneous evidences of mental life, afforded in talking, writing, emotional expression, movements of other kinds, or by memory after the state is over; (2) the absence of suggestibility. But it is needless to say that many states are found which can not be put into either of these classes.

There are many ways of inducing hypnotic states, but all agree in involving an arrest of the flight of thought, concentration of attention upon one element, restriction of the conscious field. In some very susceptible patients any sudden arrest of attention, such as that produced by an intense and unexpected stimulus, may induce a hypnotic state or some other form of disordination. A sudden flash of light, or the clang of a loud gong, has been known to produce this effect. But generally the concentration of attention must last some time, and it is usually necessary that the patient should voluntarily co-operate with the hypnotizer. One of the easiest methods of getting him to do this is to tell him to go to sleep, for we all, in trying to go to sleep, do precisely what

we should do in order to be hypnotized. Often the attention is riveted upon a bright spot, upon a sound, a sensation of touch, or even upon a thought. As it is very difficult to hold attention upon an absolutely unchanging thing, it is customary to help the patient by providing some monotonous variation. This is the chief function of the "mesmeric passes" of which we hear so much, of the revolving mirrors, oscillating pendulum, etc.

Whenever the normal flow of consciousness is thus interrupted, there is a tendency for the patient to fall asleep. It would seem as if the other elements—those which are prevented from getting into the upper consciousness—lose their co-ordination and coherence; they no longer faithfully mirror the past or paint the future, they become broken, dislocated, "dreamy," and finally die away altogether. Then the element which has occupied attention also dies away, and the patient has reached the deepest stage of hypnotic lethargy. I asked one of my patients, while he was apparently sunk in a deep lethargy, what he was thinking of. He told me in a halting, broken way that he was in his own home, it was about eight o'clock at night, he was playing cards with So-and-so; I was at a neighboring table, also playing cards, etc. In what respect does this differ from the ordinary dream? But more often the mind seems like a slate erased, and the only thoughts existing are those which the hypnotizer suggests.

It is often possible to trace the stages through which consciousness passes in its progress toward complete disordination and coma, and many have tried to discover some fixed relation between these stages. There is, I think, none, but there are some recurring sequences. Usually the control of movement by thought is first impaired. The patient feels himself becoming weak, his limbs grow heavy, the more delicately co-ordinated muscle groups of the eyelids, lips, and fingers become paralyzed, then the larger groups are affected. Sometimes one side of the body yields before the other; and sometimes, instead of paralysis, rigidity supervenes. I remember one patient who, when commanded to shut his eyes, instantly "went off" like a spring released, becoming as rigid as a log, and we had great ado to "limber him up" again.

If the patient be left to himself he will either awake of himself or fall into a normal sleep, from which all signs of suggestibility, catalepsy, etc., have disappeared. This is most easily interpreted upon the supposition that hypnotic states are in fact only imperfect forms of sleep, and therefore unstable, tending to resolve themselves in either the one direction or the other. The fact that hypnotic states may be produced not only by putting a waking man partly asleep, but also by partly waking a sleeping man, would point to the same conclusion.

The suggestibility which is so characteristic of hypnotic states probably depends upon the persistence of that portion of the patient's consciousness which represents the hypnotizer, while all else has either disappeared, or become much weakened by dissociation from its accustomed re-enforcing elements. The hypnotizer keeps talking to the patient, touching and stroking him. and he has in consequence no opportunity to fall asleep to *him*, R—— told me that even when his consciousness of the position of his own body was almost lost, and the sounds of the outer world seemed dull and muffled, the tones of my voice and my lightest touch remained as distinct as ever. The consciousness of the hypnotizer is a center from which radiate new forces, and sometimes, when memory is preserved, the patient may be able to describe the first collisions between the enfeebled upper consciousness and the foreign element. Take Dr. Cocke's account of his own experiences:

"He then said to me, 'You can not open your eyes.' The motor apparatus of my lids would not seemingly respond to my will, yet I was conscious that while one part of my mind wanted to open my eyes, another part did not want to, so I was in a paradoxical state: I believed that I could open my eyes and yet could not. The feeling of not wishing to open them was not based upon any desire to please the operator. . . . He told me that I was asleep, and placed my hand over my head, and stated that it was rigid, and that I could not put it down. Again, a part of my consciousness wanted to put it down and another part did not. He stroked my arm and told me that it was growing numb, that it was growing insensible. He told me that I had no feeling in it. He said, 'You have no feeling in it, have you?' I said 'No,' and I knew that I said 'No,' yet I knew that I had feeling in it, and yet believed that I had no feeling in it. . . . I was not conscious of my body at all, but was painfully conscious of the two contradictory elements within me. I knew that my body existed, but could not prove it to myself. I knew that the statements made by the operator were, in a measure, untrue. I obeyed them voluntarily and involuntarily."

As a brief outline of the salient features of typical hypnotic states the above must suffice, but one must remember that many anomalous states are found to perplex the student. Sometimes one meets with profound lethargy with no suggestibility; at others, the patient becomes extremely suggestible without a sign of sleep, and is afterward found to have no memory of the suggestible stage. Occasionally the attempt to produce a hypnotic state throws the patient into a trancelike nightmare, from which it is very difficult to rescue him. Sometimes it is difficult to get the patient entirely awake, or, even if awake and conscious, some

disordinated elements may persistently refuse to effect union with the upper consciousness. A friend of mine, on awaking a patient, found her unable to speak or swallow, and some anxious hours slipped by before he succeeded in restoring her power over the paralyzed muscles. Altogether hypnosis is decidedly a dangerous thing to meddle with.

Many typical trance states are brought about, it would seem, by what may be described as the hypertrophy of some perception or sensation or system of ideas. This abnormal growth may be in either or both of two directions. In the first place, it may be an actual increase in intensity and complexity. This is not uncommon in all forms of disordination; thus, Dr. Cocke says that when he tried to hypnotize himself, he first noticed a ringing in the ears, then this "noise in my ears grew louder and louder. The roar became deafening. It crackled like a mighty fire. . . . I heard above the roar reports which sounded like artillery or musketry. Then, above the din or the noise, a musical chord. I seemed to be absorbed in this chord. I knew nothing else. The world existed for me only in the tones of this mighty chord." But the development of the state may be not merely a development in intensity and complexity, but also in its importance considered as an element of consciousness. I have shown in my previous papers that consciousness tends to assume a certain form in which some one group is more clear and distinct than the others. This is what we call the "center of attention" or "focus" of consciousness. I have also shown that when any one group becomes focal all others become less clear and distinct, and may even be driven out of consciousness altogether. Now, in trance states this seems often to happen. In the hypnotic states the element upon which attention is fixed itself disappears; in trances, it and its associated states take possession of the focus, drive out all other states, and serve as the starting point for dreams, hallucinations, and visions of the most complex kind. For the same reason, suggestibility is seldom found in trance. There is no awareness of the hypnotizer to serve as a center of activity and the hypertrophied state usually proves strong enough to resist interference from without.

The close relation between hypnosis and trance is well shown by the case of M——. He is about twenty-five years of age; by profession a bookkeeper, he has proved himself capable and efficient, and, although he has always been of somewhat delicate health, he is quiet in his demeanor, and not in the least hysterical in the vulgar sense of the word. Once, when a child, he was playing with a toy locomotive; the alcohol used to generate steam was spilled upon the floor and caught fire; in great terror he ran away, seized the doorknob, and then became fixed and motionless,

unable to cry for help or to run. At another time, when about twelve years old, his grandfather died. He stole unobserved into the room where the body lay and lifted the shroud. No sooner had his eyes fallen upon the dead face than he lost all power of thought and of movement and remained fixed, the shroud uplifted in his hand and his eyes staring at the corpse, until some one came in and drew him away. As soon as I heard this account it struck me that he would probably prove to be a good hypnotic patient. Although himself very skeptical, he allowed me to try, and in three minutes I had him in a deep lethargy in which he was almost absolutely suggestible. It did not occur to me at the time to look for signs of incoördination, but two years later I found that his visual field was much restricted—that is, he was blind to its outlying portions—and also that his sensation of touch was more or less impaired. I have no doubt that the facility with which his upper consciousness was both accidentally and intentionally displaced sprang from the same conditions of which these symptoms of sensory incoördination gave evidence.

Hypertrophy of these two kinds may be the lot of any mental state. When it is a percept that usurps the conscious field, we speak of the patient as being "fascinated"; if the percept is attended by great emotional disturbance, we use such phrases as "spellbound with horror," "drunk with joy," etc. When the hypertrophied states are chiefly ideas without marked emotional accompaniments, we speak of the patient as being "in trance," "seeing a vision," or simply as "dreaming." If the visions are accompanied by intensely pleasurable emotions the state is termed "ecstasy." In the higher grades of ecstasy the concrete visions disappear and clear consciousness is lost in a flood of emotions of an intensely pleasurable character. The types of trance in which the emotion is acutely disagreeable—grief, terror, remorse—are usually classed as diseases, partly because they unfit the patient to a greater degree for the duties of life, and partly because they often spring from organic disease, especially of nutrition. The disordered physiological processes give rise to floods of vague but intensely disagreeable sensations, and these in turn generate the horrible and terrifying visions. Many trance states are revealed in the patient's movements, but for the present I shall speak only of those which are remembered and described afterward.

The attainment of ecstasy has been the aim of many religious sects in ancient and modern times, by whom it is conceived to be a direct union with the Divine; these form an important branch of the group of religious mystics, all of whom believe that the human soul is capable of direct union with God during this present life. But our information as to the various possible types of ecstasy is very defective. The essential element is the

flood of pleasure, but the sensory elements may be of any and all kinds.

One form is characterized by the appearance of a beautiful light, far more pure and brilliant than any commonly experienced. It is probable that this light is due to the hypertrophy of the vague visual sensations which we always experience in darkness—what the Germans call the eye's *Eigenlicht.* Plotinus, the Neo-Platonic philosopher (*circa* 204–269 A. D.), seems to have experienced this type of ecstasy, and has left us many descriptions of it, and of his methods of attaining it, albeit couched in rather obscure language. "Often," he says (Ennead IV, book viii, chap. 1), "I awake from the body to myself, I come to be outside all else but within myself, I see a great and wonderful beauty. Then am I most assured of the supreme happiness of my lot, for I have entered into the best life and am become one with God. . . . After thus abiding in the Divine, I descend from intuition to thought, and while descending I can not tell how I descend, or how my soul has got within my body." He thus describes his method (Ennead VI, book ix, chap. 7): "In your contemplation cast not your thought without, for God is not in any one place, depriving other things of himself, but is present *there* to him that can touch him, and to him that can not he is not present. As in other cases one can not think anything while thinking and attending to something else, but must add nothing to that which is thought, that it alone may be that which is thought; so also here one must know that he can not, while he has the image of anything else in mind, apprehend God, that other image being active the while, nor can the soul, while possessed and controlled by other things, receive the image of their opposite. . . . Every soul must let go all without and turn within, must not be attracted toward any outer thing, but must lose consciousness of all such, first of her condition and then of her thoughts, and after losing consciousness of herself also must be given over to the vision of God." In another passage (Ennead V, book v, chap. 7) he draws a distinction between light proper and that which is illumined by it; usually we see the latter only, but we can become conscious of the former also. For example, with closed eyes and in total darkness we see a pure light which is generated by the eye itself. "So also the mind, wrapping itself about from other things, and withdrawing within, seeing nothing, will behold light, not here and there, but pure light alone, of itself suddenly shining, so that" (chap. 8) "it can not tell whence it shone, whether from without or from within, nor can one say, after it has departed, that it was within or not within. One should not ask whence, for there is no whence; it does not come, nor does it go anywhither, but shines, and then ceases to shine. One should not therefore

seek it, but quietly wait until it shines, first preparing one's self to behold it, as the eye awaits the rising of the sun. The sun appearing above the horizon—out of the ocean, as the poets say—presents itself to our eyesight. But this other light, of which the sun is an imitation, whence is it to rise, and above what is it to appear? It rises above the contemplating mind, for the mind fixes itself upon the contemplation." Again (Ennead VI, book ix, chap. 9), "There the soul beholds God and herself in the only way permitted, herself radiant, full of intelligible light, nay rather herself all pure light, weightless, buoyant (κοῦφον), becoming God—nay, already become God."

The sect known in the eleventh century as Hesychasts, and later the Omphalopsychics of Mount Athos, claimed to have, and doubtless did have, the same experience. Prof. Preyer, in a note to his *Hypnotismus*, has given an interesting account of them. Their method was to drop the chin upon the breast, fix the eyes upon the navel, and wait for the light to burst upon them. A great ecclesiastical controversy arose over these practices. The language which George Fox and the early Quakers use of the "inner light" seems to point to the same thing. One of my graduate students, while under ether, had a similar experience, which makes an excellent commentary upon Plotinus's statement that the soul is "pure light." "I took form, I was a body of light in an abyss of ethereal gray; in form I was, as memory reproduces size, eighteen inches by eight, a rounded disk: I was not *looking* at myself, but I knew and *saw* myself." Such experiences would seem, from my own inquiries, to be far from uncommon, and I would be grateful to any of my readers who can give me more cases.

Among the monks and nuns of the mediæval Church ecstatic states were common. The constant fasting and loss of sleep to which many of these saints condemned themselves are known upon independent evidence to be fruitful sources of hallucinations, and prolonged meditation upon a given topic determined the general form of the vision. The enforced celibacy of the monastic life and the practice of self-torture were further conditions of the greatest importance. Enforced celibacy frequently gives rise to reflex neuroses, and self-torture is in many neurotic individuals a direct stimulus to the very passions which the celibate most desires to repress. It is not surprising, therefore, that the religious ecstasies of the ascetic frequently assume a highly erotic form, although expressed in the most chaste language, and alternate with apparitions of the devil in the forms of *incubi* and *succubæ*. Prof. Mantegazza has given interesting accounts of some of these religious ecstatics and visionaries, and I shall abbreviate a few of them.

Margareta Maria Alacoque was possessed by a desire to emulate the sufferings of Jesus, and inflicted upon herself such horrible tortures that her Mother Superior felt called upon to interfere, although some were inflicted by the express command of God. Is it surprising that she passed much of her time in a state of delirious love for her "heavenly bridegroom," constantly seeing visions and receiving revelations?

Anna Katharina Emmerich has described for us most vividly a condition of ecstatic trance in which the consciousness of the real world was not wholly lost. It is analogous to the above-quoted experience of Dr. Cocke. "I see this not with my eyes, but rather, as it seems to me, with my heart here in the midst of my breast. This causes perspiration to break out on that spot. At the same moment I see the persons and objects about me, but do not trouble myself about them; I do not even know who they are—and even at this moment, as I speak, I *see*. . . . For some days I have been continuously in a supernatural vision. I have to use compulsion upon myself, for in the midst of my conversation with others I see entirely different pictures before me and hear my own voice and the voices of others sounding dull and muffled as from an empty vessel. . . . My reply to what is said to me falls from my lips easily, and often with more vivacity than usual, although afterward I do not know what I said, yet I speak coherently and intelligibly. It is very hard for me to keep myself in this double state. With my eyes I see my surroundings dimly, enshrouded in a veil, as one does when trying to fall asleep and just beginning to dream. The inner vision desires to sweep me away with violence, and is far more clear and brilliant than the natural, but it makes no use of my eyes."

But St. Theresa has left us, perhaps, the best account of ecstasy that we possess. One should note the complex hallucinations of all the senses which served to bring about the true ecstasies.

"One day, after I had prayed and besought the good God that he would help me to do his will in all things, I began the song of praise, and as I invoked him there came to me an ecstasy that almost put me beside myself. . . . I heard these words: 'Henceforward it is my will that thou shalt speak no more with men but with angels only.'" "These inner addresses of God to the soul consist of quite clear and plain words, but are not heard with the bodily ear. . . . One day, as I was praying, God vouchsafed to show me his hands only; their beauty was so great that I have no words with which to describe them. A few days later I saw his divine countenance also, and was, I think, entirely absorbed in it. . . . While he spoke to me, I beheld that majestic beauty, and the words which that beautiful, divine mouth spoke to me breathed an infinite sweetness. In those happy moments I felt an intense

desire to see the color and size of his eyes, that I might tell of them afterward, but this favor I never won. All my efforts only caused the vision to disappear." "As the clouds draw to themselves the vapors of earth, so does he draw our souls to himself, ravishes them out of themselves, brings them upon the clouds of his majesty to heaven with him, and begins to reveal to them the mysteries of the kingdom which he has prepared for them. . . . In these ecstasies the soul seems to leave the body. Hence the natural warmth diminishes, the limbs slowly grow cold, although one feels the while most comfortable. In the prayer of union, in which we find ourselves already in our native country, we can almost always resist the divine attraction, though it be with difficulty and with great effort, but not in ecstasy; all resistance is then usually impossible. Before one thinks there comes a shock so sudden and mighty that one sees and feels as if that cloud from heaven, or that divine eagle, had swept one away and borne one off in flight." "This condition is a sleep of the mental powers, in which they, without being wholly merged in God, yet can not tell how they work. The pleasure, the bliss, is incomparably greater than in the preceding state of prayer. The soul is overflowed with the water of God's grace, which flows full to the banks. She can not and will not go either forward or backward, and only glows with the desire to enjoy such transcendent majesty. . . . My state then seems to me an absolute death to all worldly things and a ravishment in God. I know no fit simile for what the soul then feels. She no longer knows what she does, whether she talks, is silent, laughs, or weeps. It is like a blissful delirium, a heavenly madness, in which one learns true wisdom; in short, it is a sort of most exquisite bliss."

With these few illustrations I must turn from the forms of trance which appear to result from the hypertrophy of some mental state to a very different type. From the theoretical point of view we would expect to find the lines of cleavage—so to speak—in disordination taking different directions in different people. In the cases of which I have been speaking the mental co-ordination would seem to be pretty much dissolved or displaced. In other cases, to which I shall return later—those of so-called secondary personality—we shall find the lines of cleavage relatively few, and constant in their direction and location. But to the trance states proper belong those forms of disordination in which the inner life of thought is left intact while dissociated from movement, from sensation, or from both. The chronic cases in which some movements or some sensations only are lost are grouped under hysteria rather than under trance; the more complete and transitory forms properly belong to trance.

Of the second of these three conceivable cases, in which all

sensation is lost while the power of movement remains, I know of no illustration. But the earlier experience of Ansel Bourne comes very near it. He was walking down a road and felt slightly dizzy; went and seated himself upon a stone. "In an instant,... it seemed as though some powerful hand drew something down over his head, and then over his face, and finally over his whole body; depriving him of his sight, his hearing, and his speech, and rendering him perfectly helpless. Yet he had as perfect power of thought as at any time in his life." In his case all was gone except touch and the power of voluntary movement with the exception of speech. The details of this classical case can be found in Dr. Richard Hodgson's article, in the Proceedings of the Society for Psychical Research, vol. vii, page 221.

The converse, loss of movement without loss of sensation, is not uncommon; indeed, is probably only too common. A case is given by Alexander Crichton, M. D., in his work on Mental Derangement, vol. ii, page 87: "A young lady, an attendant upon the Princess of ——, after having been confined to her bed for a great length of time with a violent nervous disorder, was at last, to all appearance, deprived of life. Her lips were quite pale, her countenance resembled the countenance of a dead person, and her body grew cold. She was removed from the room in which she died, was laid in a coffin, and the day of her funeral was fixed upon. The day arrived, and, according to the custom of the country, funeral songs and hymns were sung before the door. Just as the people were about to nail on the lid of the coffin, a kind of perspiration was observed to appear on the surface of her body. It grew greater every moment, and at last a kind of convulsive motion was observed in the hands and feet of the corpse. A few minutes after, during which time fresh signs of returning life appeared, she at once opened her eyes and uttered a most pitiable shriek. Physicians were quickly procured, and in the course of a few days she was considerably restored and is probably alive at this day. The description which she herself gave of her situation is extremely remarkable, and forms a curious and authentic addition to psychology. She said it seemed to her, as if in a dream, that she was really dead; yet she was perfectly conscious of all that happened around her in this dreadful state. She distinctly heard her friends speaking and lamenting her death at the side of her coffin. She felt them pull on the dead-clothes and lay her in them. This feeling produced a mental anxiety which is indescribable. She tried to cry, but her soul was without power, and could not act upon her body. She had the contradictory feeling as if she were in her own body and yet not in it, at one and the same time. It was equally impossible for her to stretch out her arm or to open her eyes as to cry, although she continually en-

deavored to do so. The internal anguish of her mind was, however, at its utmost height when the funeral hymns began to be sung, and when the lid of the coffin began to be nailed on. The thought that she was to be buried alive was the first one that gave activity to her soul, and caused it to operate upon her corporeal frame."

This account, being anonymous, is not as well authenticated as one could wish, but to me it seems credible because I have not only known several persons who have had analogous experiences, but I have had one or two myself. My experiences belonged however to the third type, in which both movement and sensation are dissociated from thought. The first was in March of 1892. I was staying at a *pension* in Florence. I had arrived the preceding evening and was in excellent health. I came to consciousness after a dreamless sleep, to find myself paralyzed, I think anæsthetic also, but am not sure of that, and I felt as if I were struggling with an alien and hostile personality for the possession of my own body. With a violent effort I regained control of myself, turned over with the thought, "What a horrible dream!" and tried to go to sleep. The same thing recurred. Again I shook it off. This happened three or four times, and the last time it was only with the greatest difficulty and after the most desperate struggles that I expelled, as it seemed to me, my enemy, got out of bed, and opened the shutters. I was somewhat frightened, but knew enough of such phenomena to interpret it much as I have here done. Four or five times in the next four months I had similar experiences. The last was in July. I was at a hotel in Liverpool, and awoke to find myself absolutely paralyzed and absolutely anæsthetic, but with no consciousness of the alien personality. I was vividly conscious; a little alarmed, I remembered the previous occurrences of the same state, remembered writing to a friend about it, speculated about its cause, tried frequently in vain to break it. Finally, as I thought, I succeeded. With a great effort I sat upright in bed, still in total darkness, and at that moment the spell was broken. I was lying flat on my back. It was a bright summer morning and the sunlight was streaming in through the windows. Two of my friends —one an artist and the other a professor of law in a well-known university—have told me of the same experience, and both had noted that the execution of the least movement, as of the little finger, would break the spell.

We must conceive of such states as due to an imperfect awakening. The normal co-ordination of waking life is not yet fully restored. Very often in cases of this sort the patient's consciousness seems to be separated from his body, sometimes appears to visit distant parts of the earth and at others to go into

the other life and have communion with angels and spirits, occasionally it even sees God himself. In many such hallucinatory experiences there is a curious constancy of type which, with our scanty information, we can not at present explain, and I would be glad to receive authentic accounts of any cases known to my readers.

THE NEW GEOGRAPHY.

By ALBERT PERRY BRIGHAM.

THE doctrine that land forms have had a history chiefly distinguishes the new geography from the old. Geography, indeed, takes account of sea as well as land, of the phenomena of the atmosphere, the distribution of organisms, including man, of economic products and political divisions. But the new phase of geography, which is sometimes known as physiography, and later, as geomorphology, is not an isolated and formal element of the science; it rather underlies the whole, modifying or, more truly, controlling climate, organic distribution, and the history of man. The new geography can not, therefore, be charged with infringing upon the rights of the old, for it contributes vitality, unity, and continuity to the whole range of geographic fact and theory; it rejects absolutely the category of the author of one of our text-books in physical geography, that the air, the water, and the land are "the three dead geographic forms."

Geography is sometimes defined as a description of the earth as it is, without reference to its past. One author has called it the science of distribution, but well adds that because it is a science it can not rest in a mere record, but must have the causes. The new movement has simply applied the evolutionary principle to geography, giving it the life and freedom which this doctrine has imparted to all other sciences in our day. It has been seriously asked whether the new notion of geography does not confuse it with geology. Thus the minority report of the Conference on Geography to the Committee of Ten criticises the majority report as bearing too plainly the marks of the geologist's hand. It may as well be frankly admitted that geography and geology overlap. All sciences transgress each other's boundaries, and all bounds in Nature are largely matters of convenience. Geology never truly interpreted terrestrial history until, with Hutton and Lyell, it took to studying geography. Nor will the geographer understand the earth which he sees until he takes account of geology. Land forms can not be truly seen or faithfully described until seen and described in the light of their origin. Such forms will hide themselves from the student who thinks they are dead. For him they

might nearly as well be buried. The geologist who seeks, for example, the causes of volcanism, will find help in his study of the distribution and relative action of existing volcanoes—in other words, he can not keep from geography. The geographer, in his turn, needs the perspective of ancient volcanic history, if he would appreciate his own facts. Because he has commonly had no such vista, he has burdened generations of boys with the solemn blunder that a volcano is a burning mountain. Thus we may vindicate for each science its own center while granting a generous measure of common facts. The difference is in the point of view, the aim, and method of treatment; the geologist seeks largely that which has been, the geographer that which is, and each must be known in the light of the other. It is precisely the case with two biologists, one of whom studies living, the other fossil, forms. The day is past when they can work apart; yet none would deny that their fields are reasonably differentiated.

The new geography is a recent growth. Its facts and principles are little diffused and have not found their way into text-books. Thus it came about that the Conference report on geography is characterized as the most revolutionary of all those received by the Committee of Ten on secondary-school studies. Even scientific surveys of the several States do not yet show much impress of the new doctrines. Prof. Davis, the geographer of Harvard University, affirms that his students search, with meager reward, for accounts of physical features in the literature of the several States. As the same writer has truthfully said, systematic study of topography is largely American, and for the reason that the broad object lessons of the Appalachians and of the West gave our scholars the opportunity and the stimulus to lead in such researches.

The central principle of the new geography established by Powell, Dutton, Gilbert, Davis, and other American geographers and geologists is the doctrine of a base level of erosion as the goal of the destructive processes. Given an early "constructional" land surface, such as a newly raised sea bottom, and it will pass through what is called a cycle of development. Youth, with extended uplands and steep, narrow valleys, is followed by a much dissected, highly diversified topography marking the stage of maturity, whence is a gradual passage to the low reliefs, slight gradients, and quiet monotony of old age. During this cycle all forms of scenery have place, and in untrammeled variety, dependent upon climate and the constitution and structure of the mass upon which this land sculpture is wrought. Thus the horizontal beds of the Catskills give one type, the folded sediments of the Appalachians another, and the crystalline masses of the Adirondacks a third. Before such a cycle is completed in an actual base

level, a new cycle is often introduced, by massive uplifts or depressions of the region concerned. All these principles are illustrated in infinite detail on our Atlantic seaboard from New England to Georgia, and the new method is fast becoming a master key for unlocking both the geological history and present meaning of all continental areas. McGee goes so far as to say that "nearly as much information concerning the geologic history of the Atlantic slope has been obtained from the topographic configuration of the region within two years (1887 and 1888) as was gathered from the sediments of the coastal plain and their contained fossils in two generations." Davis urges the co-operation of State surveys in such advanced and rational geographic work, and with a view to reports which shall be of immediate service to the public and to the schools. A large element in this geographic advance has been the emphasis laid upon geographic work by Major Powell as Director of the United States Geological Survey, a policy with which Mr. Walcott, the present director, appears to be in fullest accord. A good map reveals more land history to a trained geographer of the modern school than most others can find out in the actual field. The geologists, teachers of geography, and indeed all citizens of New York are losers by the failure of our legislators to provide more liberally and promptly for the study of our geography by new methods. A great commonwealth, which Prof. Hall and his associates made classic geologic ground for all time, finds the knowledge of its geography in a backward state as compared with its neighbors, Massachusetts, Connecticut, New Jersey, and Pennsylvania.

What place is the new geography to have in our system of education? This just now is the question of importance and the center of much discussion. Geography in the lower schools has served to impart a group of facts about the world, which respectability and convenience require a youth to have. Cultural value has not been enough considered, and from the higher schools the subject has more often been absent. With the tendency of the times, geography has of late been taught to the child more from out-of-door and local facts, and so has come nearer the new geography in its spirit. But the teaching yet lacks breadth and strength, because the principles of the subject have not yet become available to teachers, except in favored centers. That geography of the new type lends itself to the training of the reason there can be no question. The causes of geographic forms arouse inquiry in nearly all persons. Minds of all grades become alert when the origin of soils, rocks, fossils, valleys, terraces, lakes, swamps, hills, waterfalls, mountains, and continents is explained in common language. A discreet teacher, at home in the subject, has no difficulty in bringing the main doctrines of geographic

development within the comprehension of children. It is not hard to conceive a country of hills and valleys as a surface partly worn toward a goal of lowland denudation, and then to find in the forms visible from the schoolhouse window ever-varying episodes in this history. It is not to be understood that this larger conception will be put upon the pupil at the outset; he will rather proceed from the minor passages of the land history to its main and grand movement. The brook, gravel bank, ravine, and hillock will lead to a mental picture of the township, county, State, and continent. And it is not to be forgotten that the animals and plants, clouds and storms, climate and productions, highways, cities, and all other material of geography will have their place in the teaching; it is only held that they will gather new meaning as they take their places in a comprehensive scheme of geographic development. It is of small account that the new teaching has what may be called a geologic aspect; names matter little when the only rational knowledge of geography is concerned.

Prof. W. B. Powell has given in the National Geographic Magazine an elaborate outline of the progress in the public schools of Washington toward such a rational understanding of the geography of the United States, beginning with the particular and working toward the general, in the field and by laboratory methods, as with specimens, maps, drawing, and sand modeling. The fullest pedagogical statement of the meaning and needs of the new geography for schools below college grade is contained in the Conference report on geography, to which reference has been made. The names appended to it stamp it as a representative utterance, and it is enough here to refer the interested reader to the document itself, only citing the final paragraph of the discussion of it by President Eliot's committee: "They (the Conference) recommend a study of physical geography, which would embrace in its scope the elements of half a dozen natural sciences and would bind together in one sheaf the various gleanings which the pupils would have gathered from widely separated fields. There can be no doubt that the study would be interesting, informing, and developing, or that it would be difficult and in every way substantial."

Geography is winning its way to a place in the college and the university. Objection has been raised for the reason tersely stated by some one that the subject is "a graphy and not a logy." But we have seen that the new geography is not only a descriptive and distributive body of truth; it is historical and causal. The older geography has allied itself, so far as it has had place in the university, chiefly with history. The new geography offers a yet larger contribution to history, but will ally itself more closely

with the sciences of Nature, particularly geology. At the same time it will gain in its philosophical aspects, bringing it into harmony with Krapotkin's definition as "in its higher stages a philosophical review of knowledge acquired by different branches of science."

I have recently compared the catalogues of fifty of the better-known American colleges and universities. Thirty-three of these documents afford no reason to suppose that geography receives systematic attention in their respective institutions. Of the remaining seventeen, Harvard University and the University of Chicago give the fullest measure of instruction, and wholly, it scarcely need be added, of the most progressive type. In both, geography makes part of the department of geology. Harvard has, as is well known, a thoroughly equipped geographic laboratory, and offers largely attended elementary and advanced courses in meteorology and physical geography. Among the subjects of research by advanced special students last year were: the topographical development of shore lines, the flood plain of the Mississippi, the Great Plains of the West, the effect of local topography on general winds, and the features of arctic climate. In Chicago we find courses in physiography or genetic geography; in geographic geology, treating the origin, development, and destruction of geographic features and the significance of landscape contours, or geophysiognomy. There are laboratory work in geographic geology, and a course in what is called dynamic geography, inclusive of the agencies involved in geographic evolution. Yale offers one course in physical geography, embracing the elements of dynamic geology and natural history; also one course of twelve lectures on physical geography in relation to political history. Princeton has two courses, physical geography proper, based on Guyot's text-book, and physical geography in relation to history. Cornell has one course, with emphasis on development of topographic forms, and also a course in glacial geology. Michigan does not offer the subject formally, but the development of topography is taught under geology. Vassar, Hamilton, Rochester, Wesleyan, and North Carolina give instruction in physiography. Leland Stanford, Jr., has a course in topographic geology, and Oberlin a course in quaternary geology. At Amherst the subject is treated briefly with historical geology, and at Colgate seminary and field courses are given in the history of topography and in glacial geology.

In many of the above institutions, but not in all, the new geography evidently has place, though the variety of nomenclature and method shows how new the subject is to the higher schools. In several cases its presence is directly traceable to the influence of Harvard. As a whole it may be said that geography is not yet

considered a necessary theme in American colleges. When present, it is often due to the appreciation or special tastes of instructors in geology. In England, geography was recognized as a university study by Oxford and Cambridge first in 1887 and 1888. In Germany it fares better, as would be expected, though there late in recognition as compared with other subjects. In 1893, as stated by Prof. H. Wagner, there were twenty-eight professors and teachers at eighteen of the twenty-one universities of Germany, but without unanimity of conception, in some the relation to history prevailing, while in others geology and biology were the companion themes.

In America, the recently organized National Geographic Society, while most active in discovery, has done much to take geography from the field of mere exploration and build it into a science, and it has now provided, through one of the large publishing houses, a series of monographs for teachers, in which certain great geographic units in our own country are described by accomplished scholars. It is also a cheerful fact that a considerable body of pedagogical literature has grown up in this field during the last five years.

It can scarcely be needful to urge the value of the new geographic study. The sources of intellectual satisfaction are greatly multiplied, and ennobling means of recreation may be placed in the way of every intelligent person, largely apart from the expenditure of money or the possession of special opportunity. Familiar landscapes take on fresh interest, because they become vital and are for the first time really observed. Travel becomes delightful rather than, as to so many, irksome, and otherwise dreary hours are made into a fascinating opportunity for true culture. Every reader knows how much of Parkman's charm is due to his geographic sense and facile photography of locality. H. J. Mackinder, of Oxford, has remarked that "John Richard Green's Making of England is largely a deduction from geographical conditions of what must have been the course of the history." Prof. Powell suggests the ideal teaching, in saying of geography in the schools of Washington, "North America is studied physically, in which connection it is studied historically also, so that national lines or divisions are seen to move back and forth and finally become fixed by physical causes when such exist, as is the case frequently." General A. W. Greely has recently quoted the amusing remark, "It is fortunate that great rivers run by so many great cities!" Geographic study soon supplies the real logic of such connections and of those less evident, and illumines historic and economic research at every turn. The reconstruction of the geographies of geologic time must surely shed floods of light upon the development and distribution of existing organisms, including

man himself. Glacial geology also, with its vast contribution to our knowledge of the earth, past and present, supplies one of the best illustrations of the new geography in its fellowship with geology. Glaciation is mainly a matter of climate and topography, with perhaps a measure of cosmic influence; in short, it is an affair of geography. Of that keen scrutiny of surface forms carried on by glacial science the new geography has largely been born. Some will ask what economic value accrues with this vast devotion to scientific geography which the next generation will see. Surely no field of science will yield a larger intellectual harvest, and the economic significance of pure science, though sometimes out of sight, is never far away.

QUACKS AND THE REASON OF THEM.

By Dr. A. CARTAZ.

THE story is told in Joubert's Popular Errors concerning Medicine, published at Bordeaux, France, in 1579, that one Gonelle, a jester at the court of the Duke of Ferrara, insisted once upon a time that the trade which had the most followers was that of doctor. To prove his assertion, he left his home one morning to go to the palace with his nightcap on and his jaws wrapped up. The first person he met stopped him with the question, "What is the matter with you, Gonelle?" "A terrible toothache." "Oh, is that all? I'll tell you what will cure it." And every person he met had some advice to give him. When the jester reached the duke's chamber, the same question and answer were repeated. "Ah," said the prince, "I know of something that will take the pain right away." Gonelle instantly threw up his kerchief, saying: "And you too, monseigneur, are a doctor; I have only passed through one street in coming from my house to you, and have counted more than two hundred of them. I believe I could find ten thousand in the city." Whether the story is true or false, it could be told again in our days, and Gonelle would win his wager without dispute. Everybody has had opportunities to try the experiment; and there is probably no one who has not permitted himself to give friendly counsel to an ailing person in passing—good advice: "Such a person was cured by such a remedy; try it"; and to jeer at the doctors, who know nothing about the matter.

It is not strange, in view of this instinctive tendency to sympathize in the sufferings of another and to assist as far as possible in curing them, that false doctors, charlatans, should have had their day, even if only briefly at a time, in all ages and in all

quarters of the world. We can find examples of them as far back in the world's history as we have a mind to go; but the typical quacks date from the end of the sixteenth century. Beginning with this period, reputations have been established the remembrance of which has been sent down to us. Charlatans have also had their times of trouble, but the species has been preserved and perpetuated from generation to generation, from century to century, and still flourishes. Quacks still invest themselves with embroidered cloaks, wigs, and indescribable hats, or something like them, and with the help of the most astonishing blandness sell their wares, which are warranted to cure all diseases. It is not easy to learn to gain the ear of the throng, but some persons are marvelously skillful at it. Some quacks engage exclusively in special lines of practice, while others will offer a balm sovereign against all diseases. I recollect that when I was a child one Zozo passed regularly from one village to another at the time of the rural festivals, selling a vermifuge, the praises of which he sounded in a speech whose eloquent persuasiveness I have never heard excelled. The tradition is preserved also in Paris of Dr. Napolitano, who used to make his perorations in 1815, dressed in a magnificent scarlet cloak trimmed with gimp and gilt; of Duchesne, who inclosed himself in a sack and pulled a tooth with one hand and fired a pistol with the other; of Lartaud, chiropodist to the Emperor of Morocco, etc.

The type of the plumed charlatan, such as is represented in Gerard Dow's picture in the Munich Museum and Du Jardin's in the Louvre, is declining, and is now met less frequently in the large cities. It is giving place to another type, more modest in its bearing, and less noisy—the empiric, or quack doctor. He, too, lived in the former centuries, as is shown in an eighteenth-century picture of a wandering surgeon torturing a poor fellow for some trouble in his shoulder (Fig. 1). Another picture (Fig. 2) represents Michel Schuppach, known as the mountain doctor, giving a consultation in his rustic apothecary shop to a lady of the court who has two lords attending her. The corpulent old fellow is calmly looking at the flask containing the potion he is preparing, while a servant is waiting to give him the flasks he will require for completing the mysterious remedy.

Stories of these empirics of the seventeenth and eighteenth centuries might be cited by hundreds. The memoirs of the time are full of recitals of their prowess, and sometimes of their failures. Ducerf had an oil of guaiacum which, whether taken internally or rubbed on, would cause the disappearance of any disease; Caretto, an Italian who pretended to be a marquis, sold a wonderful remedy for two louis d'or per drop. A doctor of Chaudrais, near Mantes, a peasant of much good sense, who sold simples and

roots, was extraordinarily popular for a few years, and then lost his constituents one by one. Every region has had some great man of this sort. The Zouave Jacob was all the fashion in Paris under the empire, and his office was never without patients from morning till evening. A Moorish doctor of Frais Vallen, Algeria, was consulted with almost incredible faith by his countrymen and by Europeans, and gave, with his limited list of remedies—a few herbs, purgatives, and extract of cresses—some really philosophical advice, and manifested fine qualities of intelligence. Not long ago a practitioner of these arts took rooms in the best hotel in Havre and advertised by every channel the wonderful merits of the dynamotherapeutic institute. All diseases were cured by the application of plates. The innocents flocked to him, but when they found that they were hoaxed the joker had gone.

FIG. 1.—A QUACK SURGEON OF THE EIGHTEENTH CENTURY. (From an engraving of the time.)

Besides these false doctors and surgeons without diplomas, like the bone-setters, there is a whole class of amateur doctors, such as met Gonelle, ready to give advice, some in pure philanthropy, others less disinterested. The members of the French Academy of Medicine have an hour or two of fun every year at the reading of the report on secret remedies. An ingenious schemer fancies he has some potent remedy and sends the receipt to the academy; or, perhaps, it gets there indirectly. I will not venture to assert that the formula may not be indorsed sometimes—recommendations are so cheap. Among these authors of cures are illiterate persons, shepherds, furriers, country ministers, teachers, and nurses. Here, for instance, is a previously unknown recipe taken from an old notebook; here is a remedy brought down from father to son, the

composition of which has been kept in the family for generations. This one will cure every disease; that one, of more discreet pretensions, is only good for some particular disorder, generally an incurable one. A court bailiff prescribes an infallible remedy for epilepsy, consisting of a cat's skin applied to the back, rubbing the belly with ointment, and old brandy in the loins. All are made out after a model like this, and can be judged from it. A vast number of popular errors are built on the advice of these pretended specialists. A whole inventory of medicines, each more absurd than the others, may be found in books on madness. Do

FIG. 2.—RUSTIC PHARMACY. An exact representation of the room in which Michel Shappach, known as *Médecin de la Montagne* (the mountain doctor), held his consultations. Drawn from life by G. Locher in 1774. Engraved at Basle by Barthélemy Hubner in 1775. (Reduced from an engraving in the collection of M. Gaston Tissandier.)

not dispute us, say the authors; we have the facts to prove the reliability of the doctor and the sureness of the remedy.

It is certain that, whatever we may say or do, the tendency to these superstitions is not changed. The spread of instruction and of the knowledge of hygiene is of little avail in the contest against inveterate prejudices. Matters are much worse in the field of medicine proper.

There is a story of a doctor who recognized an old servant in a quack who was doing a large business, and asked him how he accounted for his success. "How many of these fifty persons

passing by," the quack said, "do you suppose are sensible persons?" "Six or seven," said the doctor. "I will give you ten of them for your clients, the rest are mine." This is not complimentary to four fifths of the human race.

I believe that we can explain how even educated and intelligent people can place credence in the virtue of strange remedies and the knowledge of absolute ignoramuses. Medicine is not, as is commonly said, the art of healing; it is the art of usually mitigating and sometimes healing. There are too many incurable diseases, or those which become so with age, by fatigues of all sorts, or by excess, for a doctor to be able to pretend to do anything but soothe and reduce the pains. A patient afflicted with such troubles can not bring himself to believe that he is condemned without remedy; and he will at any price try the possible and the impossible in the hope of finding a cure. The impotency of medicine as against his trouble induces the unhappy man to cast himself in time into the hands of any quack who can insinuate himself into his confidence. "My remedy is infallible," the quack will tell him; "try it." The spirit grows weak and gives way under the suffering that tortures and yields not; the animal, we might say, resumes its rights; and the patient abandons himself to one who will promise a wonderful cure without reserve. Then there have been wonderful cures. At the time when little was known or knowledge was imperfect about nervous affections, so curious, various, and manifold in their manifestations, what seemed like resurrections, almost miracles, sometimes took place. Such facts are satisfactorily explained now, but they were formerly astonishing and surprising. The crowd hurrahed as over a prodigy, and gave absolute confidence to it. It could not be otherwise. Whatever may happen, there will always be credulous people and always men disposed to deceive them.—*Translated for the Popular Science Monthly from La Nature.*

A CLASS in botany, under the direction of Prof. Charles E. Bessey, formed a part of the Colorado Summer School at Colorado Springs last summer. The city is situated at the foot of Pike's Peak, and within easy reach of the vegetation of the plains, the cañons, the foothills, and the strictly Alpine regions. The numerous brooks and mountain streams supplied an abundance of aquatic forms, while the damp cañons furnished all kinds of fungous growths. Lichens, mosses, and ferns were plentiful, so that every section of the vegetable kingdom was well represented. The course included lessons on the structure, physiology, classification, and distribution of plants; the lower water plants, the degenerated plants, the mossworts, and the naked and covered seeded plants. The work was divided into an elementary and an advanced course. The attendance, exceeding one hundred, was mainly composed of teachers of maturer years, in all departments of school work.

THE WAYS AND MEANS OF ANTS.

By NORMAN ROBINSON.

A FEW days since I witnessed an engineering feat on the part of a company of ants that interested me greatly. A Florida chameleon (*Anolis principalis*) had wandered into my laboratory and taken refuge under a newspaper which was lying in a chair. Some one had evidently occupied the chair without taking up the paper, with the result, of course, of crushing out the life of the unfortunate little anolis. Having occasion to use the chair, I removed the paper, and discovered the flattened-out body of the little lizard, around which a company of ants were evidently holding a consultation as to the best method of utilizing the game thus accidentally provided for them.

The particular species of emmet that was thus engaged I am not able to identify. Our Florida ants have not been very carefully studied, and I think it quite possible that this is an undescribed species. Popularly he is known here as the "racehorse" ant, and the name is certainly appropriate. Of all the fast and fussy little runabouts that his omnipresent family affords, he is far and away the supreme. It would be hard to find even among the marvels of the insect kingdom any such concentrated bundle of nerves and muscles and brains. He is a little black mite of a fellow, three millimetres (about an eighth of an inch) in length, and it takes one hundred and sixty-two of him to weigh one grain. His ordinary walk is a fast trot, but when he really gets down to business even that kangaroo among insects, the flea, can not beat him in getting over the ground or being in a dozen places apparently at the same moment. Naturally he is a terrible nuisance to housekeepers; borax, corrosive sublimate, Cayenne pepper, and all the other warranted prophylactics against the plague of ants simply amuse him. Not long since I tried all the devices I had ever heard of, and which do often prove effective with other species of ants, in a vain effort to keep this active little rogue out of a new barrel of sugar. A strong solution of corrosive sublimate was poured in a circle on the floor around the barrel. He simply waited for the floor to get dry and calmly trotted over to the alluring barrel of sweets. Three hours after trying this "poison guard" I found a colony of a hundred or so comfortably regaling themselves upon the coveted treasure. Caustic potash dissolved and used in the same way served a little better purpose, but this soon solidified into a carbonate, and its usefulness was at an end. I next procured some freshly ground and pure Cayenne pepper, which some "scientific" newspaper correspondent had recommended as an infallible protection against these little pests.

"They can not possibly walk over it," this sapient scientist declared. I spread it in liberal measure around the barrel, but, alas! for newspaper science; it is a positive fact that before I had finished my circling wall of Cayenne pepper these little black imps were racing over it by hundreds. I gave it up. There was nothing to do but to build a low table, put the legs in cans of kerosene oil, and keep on it the barrel of sugar and all other provisions that I wished to protect against these cunning little marauders. Since then I have had no further trouble with them, save in one or two instances where the kerosene was allowed to evaporate. So far as I know, this particular species of ant is rarely found—at least, gives no trouble—here in the country. It seems to be especially partial to "city life."

But to return to the ant conference over the dead body of the anolis. When I first saw them, a hundred or so of these little "racehorse" ants were scampering about in the most fussy and excited way. Two little fellows would meet, cross antennæ, and start off at a lightning pace, to repeat the performance with the next one they met. No doubt they had some plan and were really talking over the matter; but apparently it was just an indistinguishable jumble of black imps racing up and down without rhyme or reason. After watching for a moment this curiously involved but seemingly aimless dance, I left to attend to other matters. Returning in the course of half an hour, I saw to my surprise that the dead chameleon had apparently come to life, and was crawling over the edge of the chair seat. A little closer inspection, however, showed that the revival was only apparent, and that these little Sandows were actually dragging off the dead body of the anolis. This was so astonishing that I naturally gave the matter a little closer attention. It was very much as though a score of men should be caught picking up a big church and walking off with it, or half a dozen fishermen should shoulder a whale and carry it to market!

In order to estimate as nearly as possible what these ants were really doing, I placed the body of the dead lizard on the scale pan of a Becker analytical balance, and found that it weighed eight hundred and ninety-six milligrammes. Ten of the ants weighed exactly four milligrammes and a half. This, of course, gave a weight of nine twentieths of a milligramme for each ant. Thus it will be seen that these little insect Samsons were actually dragging off an animal almost two thousand times as large as themselves (exactly nineteen hundred and ninety-one times)!

How did they do it? To test the matter, I placed the dead anolis back in the wooden chair seat where I first found him. Watch in hand, I awaited events. Not an ant was in sight. One minute passed, nearly two, when a solitary scout made his ap-

pearance, and, by a series of little hesitating, jerky, zigzag trots, made his way up within about an inch of the chameleon. Either by sight or smell, or in some other way, this ant evidently recognized the lost treasure. Without a second's delay he turned sharply about and ran down the chair leg and disappeared somewhere under the matting with which the floor was covered. In a little less than a minute four ants made their appearance on the scene and carefully reconnoitred the field; this time two of them came and felt the body of the anolis, executed a few little zigzag trots, touched antennæ, and started back again for the chair leg. By this time a dozen or more had climbed on to the chair seat and were running about the dead body. Any further attempt to keep watch of individual ants was of course abandoned. Most of them did not go near the object of their gathering, but simply ran back and forth over the chair bottom in seemingly the most aimless way. After ten minutes had passed, and probably a hundred more or less of the little fellows were assembled and plenty were coming, they began to gather around the body, first four or five, then ten, twenty, thirty. There appeared to be no captain or leader, and seemingly very little concert of action. Those that came up would give a little tug, and then away possibly to some other part of the body, or may be to scamper over the chair bottom among the crowd of apparent idlers. I found it very difficult to count those that were at any moment pulling or pushing—both were evidently being done as they worked from either side—but as near as I could count, forty ants were the most that at any one time were tugging at this, to them, relatively enormous load. After trying various points with very little success, they finally gathered, about thirty of them, at the tail. This they readily swung around. They had at last "got the hang of it." Perhaps I imagined it, but it seemed to me I could see the added enthusiasm with which they now tugged away at their burden. Then the tail moved faster, then the head was pulled and pushed forward; and so, by swinging first one end and then the other, the, to them, gigantic mass was moved steadily toward the edge of the chair. I think here is a clear case of thought, afterthought, contrivance, the abandonment of one plan that proved a failure and the adoption of another that proved a success. They tried at first to move the whole weight, and found it too much for them; they then tried swinging it around one end at a time, and succeeded. What human engineering skill without tools could have done better?

One curious fact that I observed was that these ants do not fancy steady work. Most of them would come up and give a little push or pull and scamper off to join the crowd that was racing about on all sides. Occasionally one would tug away for

two or three seconds. This seemed about the extreme limit of their endurance. Possibly the muscular activity they exhibited was too intense for prolonged exertion.

And now let us make a little calculation as to the amount of force that each ant must have exerted. As before stated, here was a company of them dragging over a wooden chair seat a weight nineteen hundred and ninety-one times that of each individual engaged in the task! Supposing that forty ants were at one time at work (which is the largest number that I could count), and that the force exerted was evenly distributed (which in point of fact could not have been the case), each ant must have done at least one fortieth of the work. In other words, each of these tiny workmen was dragging or pushing forward nearly fifty times his own weight (exactly 49·75). A man of medium build weighs, we will say, one hundred and fifty pounds. Fifty times this is seven thousand five hundred pounds, or three tons and three quarters. So that even Sandow in relative strength is a long way inferior to these curious little "racehorse" ants.

THE SOCIAL FUNCTION OF WEALTH.

By M. PAUL LEROY BEAULIEU.

WEALTH—concentrated to a high degree in the hands of an individual—has a mission, a social function, which is derived from its very nature and which it alone can properly fulfill. Wealth has the power of commanding production and labor, and consequently of giving a direction to both; indirectly, without show, but very effectively, more intimately, and more familiarly, a rich man, like a politician, is a leader of men. Fortune, which is abundant wealth in the hands of an individual, constitutes a power of administration. This power of administration, whether acquired or inherited, can not be used while affairs dependent on one's self are allowed to drift; for the fortune will in that case probably be dispersed and will escape the hands that are holding it. One may try using it in a purely selfish interest; he will be likely to become richer and richer, accumulating capital and making himself useful to society by new expenditures; but he will not fulfill the social function of fortune. One may, on the other hand, place himself at a high general point of view in using this power without excluding his personality.

The gospel precept, repeated in all Christian morals, that the wealthy are the administrators of the goods of the poor, or the economists of the poor, is a pious maxim not wholly practicable from the human point of view; but it embodies the principles of

the matter, particularly in its second phrase. According to Mr. Frederic Harrison's inquiry, in The Forum of 1894, into the habits of wealthy men in a republic, the first duty of fortune, as of capital in general, is to take care of itself. The prime error, whether individual, or of the family, or social, is to let one's property diminish in value; that property being a fund, susceptible of being perpetuated, useful for the production and development of enterprises, destruction, waste, or depreciation of it, whether by prodigality or by imprudent generosity, is a misdemeanor. In the interest of society, as well as of the family and the person, every one ought to respect and maintain his fortune.

Only income can be legitimately consumed. In using this, a liberal mode of living is permissible, and involves nothing opposed to morals. It is, in fact, generally commendable, provided the expenditure is within the receipt. Judicious luxury, the artistic decoration of life, without vain ostentation and frivolous arrogance, is also legitimate; but it is better to let the expenditure bear upon objects that will endure; that the generations should leave lasting traces of the elegancies of their career is legitimate. An economical obligation—and one he certainly owes to his family, if not a moral one—lies upon the wealthy man to maintain a reasonable increase of his fortune. He should continue to save a certain proportion and to create capital in order to procure for society, as a whole, the means of applying new inventions and discoveries, and to augment the productive fund with which to assuage the troubles and increase the conveniences of mankind. To save continues to be a duty in whatever situation of fortune, if only to guard against the accidents that are always possible. While the danger of such accidents has been proved to be real by past experience, which has shown that few fortunes can exist without depreciation for more than a few generations, the amount to be laid up need not absorb all the surplus beyond that sum needed to maintain a liberal and comfortable style of living. The duty of making judicious investments imposes on the man of wealth the necessity of exercising a degree of boldness without going into rashness, and of giving much reflection and study to his business. This furnishes an additional reason for prudence in saving, in order to compensate for the mistakes that may be made in investing.

The social function of wealth comes into play when the disposition is to be determined of the surplus that is left after a comfortable style of living with judicious luxury is provided for, and a proper amount has been put away.

Persons of great wealth have large opportunities for usefulness in associating themselves with and participating in efforts which seem useful, but the results of which are uncertain. Many

discoveries and inventions have to pass through a period of incubation, as recently electric lighting and the transmission of force by electricity, and now the division and dispersion of motive force into small shops, experiments in photography of colors, etc. Numerous costly efforts are necessary in seeking advance in such matters which we see to be possible and even near, but which are still far from the practicable period. Outside of the professional and technical ranks the persons who can make these experiments are not of the class who are simply at ease. At most they can only devote insignificant and insufficient sums to them. Such persons may be set to their work and kept at it by the private aid of the really wealthy, who are not asked to risk a fraction of their capital, but only a small portion of their surplus income, after all its other applications have been provided for. Wealth is thus put in the way of fulfilling its social function of assisting progress; and much more is accomplished by it in this way than the multitude think. A similar field of usefulness is found in giving assistance to agricultural experimentation. The great English lords, according to Thorold Rogers in his Economical Interpretation of History, achieved much in this direction in the seventeenth century; and Arthur Young has cited the cases of numerous gentlemen and industrial proprietors in France who improved their opportunities of thus doing good. A large estate is a free school, a field of experiments in novelties from which the neighboring small property derives a full share of benefit. The trial of new cultivations, of selected seed, of improved implements, of methods suggested by science, is the task of the opulent large proprietor or of the rich manufacturer or merchant spending his vacation or his leisure on his country estate. So these large proprietors have a mission to perform in the choice of good breeders for reproduction or selection, and in the improvement of vegetable species.

A second social function of wealth is found in enterprises requiring patronage and remunerative philanthropy. The term "remunerative philanthropy" may have an odd sound to some persons. It is, however, true that rich men render great social services by the performance of the kind of work which we have designated thus. A portion of the revenue of the wealthy might well be devoted to enterprises of general and public utility, which would also, if well directed, produce a modest but respectable remuneration. There are a number of kinds of businesses capable of returning a small profit, but in which the chances of gain, though not absent, are too limited to attract private speculators, careful only of their personal interest, which might be undertaken by wealthy men satisfied to put out a part of their revenues for low interest. An investigation made about fifteen

years ago by the Industrial Society of Upper Alsace brought to light several enterprises of this character, inspired by a philanthropic feeling, and yet giving a modest indemnification for the capital invested in them. Among them are societies of Popular Credit, of which Schulze-Delitsch and Raiffeisen have described admirable types, consumers' co-operative societies, workingmen's insurance under a variety of forms, baths and lavatories for workingmen or for the small middle class, workingmen's lodgings, cheap dining houses, and other establishments of similar character. All these organizations that concern the people are usually despised by professional speculators and by capitalists.

Wealthy men might well apply a part of their disposable revenues to enterprises of this sort, not as alms, but on the score of general utility; and there would be no impropriety in their deriving a modest interest from them. Many organizations of this kind have been formed during the past quarter of a century in England, the United States, and France, and have demonstrated the applicability of the method. Associations formed for such objects should rigorously maintain the self-supporting principle, or aim to pay their own way.

Besides the numerous examples furnished by Alsace since 1850, there are many others in demonstration of the practicability of the plan we have sketched. Some, in the shape of dwelling houses for men of small means, have been described by M. Arthur Raffalovich, in his book, *Le Logement du Pauvre* (The Housing of the Poor Man). Some very successful enterprises which might have come under this head have been carried out in the United States, England, and France. There are in England 2,372 building societies, the most of which are based on this principle, which comprised 587,856 members at the end of 1892, and had the disposal of £40,641,000, of which £24,729,000 were paid in by shareholders and £14,911,000 by depositors. Their profits amounted to £1,897,000, or five per cent of the capital devoted to the construction of convenient dwelling houses for the poor. In a very successful experiment made by a number of practical philanthropists at Lyons, France, ninety houses, containing a thousand simple but convenient and healthful suites, returned a profit of five and a half per cent, of which the investors received four per cent, the statutory maximum, while the rest went to increase the reserves. The objections which have been alleged against these enterprises are not really of great importance. It does not follow that because they are not of advantage to every one or to the poorest class they are not useful to a very considerable class of workmen and small clerks. And while there is danger that in the course of time—say after fifty or seventy-five years—they will deteriorate or become corrupt, we have no right to conclude that

they will not have rendered good service in the meantime. It only proves that nothing is lasting, and that types and methods will have to be modified, every half century, for example. These establishments foster a taste for neatness and hygienic conditions in the house, and provide models which private builders may imitate. What has thus been done in reference to the house may also be done with relation to food. In this, Lyons again has given an instructive example, in the provision that has been made there of popular restaurants with low-priced dishes, which yet pay a very convenient interest of from three to four per cent. In association with enterprises of this kind wealth performs its social function without suffering depreciation.

A third social function of wealth lies in the gratuitous patronage of unremunerative works, a sympathetic way of giving help where it will be worthily bestowed and thankfully received.

Next are great foundations of general interest, such as a few millionaires, whose names are honored and perpetuated by their deeds, have taken pleasure in making. The finest examples of this kind of benevolence have been found among the Americans and in the little states of ancient Greece; museums, schools, observatories, public parks, churches, orphanages, hospitals—institutions with which every man possessing a fortune of the first class might deem it a privilege to have his name associated. No considerable curtailment of the amount to be transmitted to heirs or gradual transformation after death of private fortunes into collective fortunes need be contemplated in these foundations. Such transformation would be of mischievous economical effect; for money, except in a few rare exceptions, is better administered by individuals who possess it than by collective organizations of any kind. Many fortunes, however, are large enough to afford considerable sums for these foundations. There are many other beneficent works that might tempt millionaires. Among objects worthy of attention are African and Asian exploration, experiments in acclimatization of animals and plants, subventions of scientific and medical investigation, and others. Under the triple form we have pointed out, the social function of wealth, as distinguished from its economical function, is to be initiative and auxiliary. This function can not be imposed by law, but must be promoted by tradition, conscience, and a taste for useful and sympathetic activity. It would be well if it were supported by a compliant public opinion, but the absence of that condition affords no reason for ignoring it.—*Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

SKETCH OF BENJAMIN SMITH BARTON.

OF the three professions formerly distinguished as "learned," that of medicine is the only one connected with natural science. Hence it is not surprising that, in the times when scientific research could seldom be pursued except as an avocation, it was frequently joined to his vocation by the physician. The history of medicine in the Old World is adorned with the names of many profound students of Nature, and in America the name of Dr. Barton stands at the head of a considerable list of eminent investigators who either followed or at least entered upon the medical profession.

BENJAMIN SMITH BARTON was one of the younger children of the Rev. Thomas Barton, an Episcopal clergyman, and was born at Lancaster, Pa., February 10, 1766. His mother was a sister of David Rittenhouse, the astronomer. He received, therefore, a double inheritance of intellectual ability, but the benefits of parental care and training were lost to him at an early age. His mother died when he was eight years old, and his father when he was fourteen. Early in the fall of 1778 Mr. Thomas Barton had left Pennsylvania, intending to go to Europe, but was taken sick before he could conveniently set sail, and died without returning to his home, May 25, 1780, at the age of fifty years.

Before leaving Lancaster Mr. Barton had placed his younger children in the care of a friend in the country near by, where they remained until after their father's death. During this period young Benjamin devoted much of his time to reading, showing considerable fondness for the subject of civil history. Being a studious boy, he naturally took less interest than boys generally do in athletic sports. His predilection for natural history, especially for botany, appeared early, and very likely had received some encouragement from his father, who is known to have been a student of Nature. In a note to his Observations on the Desiderata of Natural History Dr. Barton speaks of the "fine collection of North American minerals, which was made by my father near forty years ago, at a time when he paid more attention to this part of natural history than, so far as I know, any other person in the (then) colonies." It appears also that the Rev. Thomas Barton was a member of the American Philosophical Society, and corresponded with Linnæus on botanical subjects.

Young Benjamin early displayed a notable talent for drawing, and afterward became also remarkably skillful in etching. His artistic ability was of great service to him in sketching objects

of Nature and in criticising the illustrations prepared by others for his books. He is said to have maintained that "no man could become a nice, discriminating, and eminent botanist without possessing that acumen in perception of proportion, color, harmony of design, and obscure differences in the objects of the vegetable world which alone belong to the eye of a painter." He insisted on strict accuracy in details that even most careful naturalists would disregard. To mention an extreme instance of his exactness, he had every protuberance on the back, tail, and legs of a horned lizard counted, and required the precise number found to be represented in the drawing made for him.

In the spring of 1780 Benjamin, with one of his brothers, was placed in an academy at York, Pa., where he remained nearly two years, pursuing a course of classical study. When he was sixteen years of age his elder brother, who was living in Philadelphia, took him into his family, where he remained about four years. During this period he attended for a time the College of Philadelphia, and afterward, at the beginning of his eighteenth year, took up the study of medicine under Dr. William Shippen.

In the summer of 1785 he accompanied the commission, of which his uncle, Mr. Rittenhouse, was a member, that was engaged in running the western boundary line of Pennsylvania. Young Barton was absent from Philadelphia five months, and it was on this expedition that he gained his first acquaintance with the Indians and began his researches into their medicines and pathology, their general customs and history, which received a share of his attention for the rest of his life.

In order to obtain a thorough medical training it was at that time necessary to go abroad. Accordingly, young Barton repaired to Edinburgh in the autumn of 1786, where he studied for two years, with the exception of a few months spent in London. Having become a member of the Royal Medical Society at Edinburgh, he won the Harveian prize of that association for a dissertation on the *Hyoscyamus niger* of Linnæus (black henbane). Barton's first book was issued while he was in London, in the early part of 1787. It was a little pamphlet, entitled Observations on some Parts of Natural History: to which is prefixed an Account of some Considerable Vestiges of an Ancient Date, which have been discovered in Different Parts of North America. Considering his youth—he was only twenty-one years of age—and the fact that he was afflicted with ill health when he wrote it, this production is very creditable; but it contained some ill-founded theories and other crudities that he readily and candidly acknowledged only a few months later. For a number of reasons —among them the failure of two professors to show him courte-

sies that he had reason to expect—he left Edinburgh and took his degree at Göttingen, returning to America toward the close of the year 1789. He began to practice his profession in Philadelphia, where his knowledge of science soon caused him to be looked upon as one of the rising young men of the day.

The trustees of the College of Philadelphia having instituted a professorship of Natural History and Botany, appointed Dr. Barton, then only twenty-four years of age, to the chair. This appointment was confirmed in the following year, when the college united with the University of Pennsylvania, and was held by him for the rest of his life. Dr. Barton thus became the first instructor in natural history in Philadelphia, and probably was the first in any American college. Five years later the professorship of Materia Medica in the university became vacant, and this chair also was assigned to Dr. Barton and was held by him until he succeeded to that of Dr. Rush. On January 28, 1798, he received an appointment as one of the physicians of the Pennsylvania Hospital, which position he held for the rest of his life. Dr. Barton was a man of high ambition, and being deeply impressed by the well-deserved fame of Prof. Rush, spared no exertions to equal it. When the latter died, he very naturally desired to obtain his professorship, and his application was followed in a few months by his appointment.

Dr. Barton had been from early life subject to hæmorrhages and to attacks of gout—his period of illness while a student at Edinburgh was due to these causes—and he had further weakened his health by too great application to his scientific and professional labors. He had sustained a severe hæmorrhage just before undertaking the labor of preparing for his new position. He had delivered but two courses of lectures on the practice of medicine when his increasing ill health decided him to try the effect of a sea voyage. He accordingly sailed for France in the spring of 1815, and returned in November of that year, but without gaining the benefit hoped for. Hydrothorax came on soon after he landed in New York, and it was three weeks before he was able to reach home. His condition became rapidly worse, and on the morning of December 19, 1815, he was found dead in bed.

Only three days before his death he wrote a memoir on a genus of plants which had been named in honor of him, and requested his nephew, Dr. W. P. C. Barton, to make a drawing to accompany it. The latter did so, and read the memoir at the next meeting of the American Philosophical Society. Dr. Barton was elected to this society January 16, 1789, before his return from his medical studies abroad, and had been one of its vice-presidents since January 1, 1802. The printed Transactions of the society afford abundant evidence of his activity as a member and as a

man of science. For three years in succession, beginning with 1797, he was chosen to deliver the annual oration.

In his youth Dr. Barton had suffered the discomforts and hindrances of poverty and the persecutions of those who bore him ill will. But it was not many years before the income from his lectures and his books had lifted him above the influence of want.

Being prevented by his professional engagements from making explorations in search of plants and other objects of natural history, he employed others to collect for him, advancing his favorite sciences by this means. Frederick Pursh, in his *Flora Americæ Septentrionalis* (London, 1814), describes an excursion that he was enabled to take by the aid of Prof. Barton. Starting in the beginning of 1805, he went along the mountain chain of Virginia and the Carolinas, and returned through the coast lands, reaching Philadelphia late in the autumn. Similar assistance was extended to Thomas Nuttall, "whose zeal and services," to use the words of Dr. Barton, "have contributed essentially to extend our knowledge of the northwestern and western flora of North America, and to whom the work of Frederick Pursh is under infinite obligations." Pursh himself gives due credit for Nuttall's contributions. A genus of plants (resembling cactus), first described by them, was named *Bartonia*, in honor of "their mutual friend Dr. B. S. Barton." In a paper written by Dr. Barton, a few days before his death, he says of Nuttall:

"I became acquainted with this young Englishman in Philadelphia several years ago; and observing in him an ardent attachment to and some knowledge of botany, I omitted no opportunity of fostering his zeal, and of endeavoring to extend his knowledge. He had constant access to my house, and the benefit of my botanical books.

"In 1810 I proposed to Mr. Nuttall the undertaking of an expedition entirely at my own expense and under my immediate direction, to explore the botany, etc., of the northern and northwestern parts of the United States and the adjoining British territories." Dr. Barton further relates that Nuttall set out on this journey in April, 1810, but he deviated from the route which had been pointed out to him, having been prevailed upon to ascend the Missouri with other travelers, whose objects were principally traffic. Returning, he reached St. Louis in the autumn of 1811. "In the latter end of the year 1811, Mr. Nuttall returned to England by the way of New Orleans. Previously to his departure he transmitted to me a number of the dried specimens and seeds which he had collected." It was on this trip that Nuttall found two species of the genus that he named *Bartonia*, descriptions and specimens of which he furnished to his patron.

Among the early printed works of Dr. Barton was a Memoir concerning the Fascinating Faculty which has been ascribed to the Rattlesnake and other North American Serpents, published in 1796. He issued a supplement to this memoir four years later, and a new edition in 1814. The original paper had been read before the American Philosophical Society. He also undertook a work on the materia medica of the United States, issuing an opening part in 1798, a second part in 1804, and an edition of the two combined in 1810. His most important publication was his Elements of Botany, a work of 508 pages, octavo, illustrated with thirty plates, which first appeared in two volumes in 1803. A second edition of the first volume was issued in 1812, and of the second volume in 1814, with forty plates. After the author's death, Dr. William P. C. Barton published, in 1836, a revised edition in one volume, condensed by omitting the quotations from Latin and English poets, certain tabular views that had become antiquated, and the index. To this edition is prefixed a biographical sketch, prepared by Dr. W. P. C. Barton at the request of the Philadelphia Medical Society, of which Dr. B. S. Barton had been president from February, 1809, till he died, and read before that society February 24, 1816. The Elements of Botany was republished in London, and was translated into Russian.

Another considerable work was his New Views of the Origin of the Tribes and Nations of America, which appeared in 1798. Other subjects on which he published more or less fully were the natural history of Pennsylvania, the disease of goiter, the generation of the opossum, the principal desiderata in natural history (read before the Philadelphia Linnæan Society), *Siren lacertina*, the hellbender, the bite of the rattlesnake, the honeybee, the jerboa, and the stimulant effects of camphor upon vegetables. He issued also the first part, sixty-four pages, of a work on paleontology, entitled *Archæologiæ Americanæ Telluris Collectanea et Specimina*. In the preface to this fragment he says, "I at one time, indeed for some years together, flattered myself that I should have found leisure to have devoted a considerable portion of my life to the study of organic geology," but adds that his recent succession to the chair of Dr. Rush would prevent any extensive or systematic attention to this subject. An ardent thirst for literary fame, which was present in Prof. Barton throughout his life, made him an indefatigable student and writer. Several ambitious undertakings were left unfinished by him. The following three papers that he had read before the American Philosophical Society remained unpublished at his death: a eulogy on Dr. Priestley, with whom Dr. Barton had been acquainted; a geographical view of the trees and shrubs of North America; and a memoir (which gained the Magellanic premium) concerning a considerable num-

ber of pernicious insects of the United States. Prof. E. A. W. Zimmerman, of Brunswick, translated into German and published the memoir on the fascinating faculty of serpents and that on the bite of the rattlesnake.

In 1797 Dr. Barton married a daughter of Mr. Edward Pennington, of Philadelphia, who, with their only children, a son and a daughter, survived him. He named his son after Mr. Thomas Pennant, an English naturalist and author of Arctic Zoölogy, with whom he became acquainted while a medical student.

Dr. Barton was extremely cautious about accepting human testimony in matters of science, and in one of his publications he declares that "credulity is the most injurious feature in the character of the naturalist as well as that of the historian. Its influence in one individual is often felt and propagated through many ages. Unfortunately, too, it has been the vice of naturalists, or those who have touched on questions relative to natural history."

In a general description of Prof. Barton his nephew says: "As a medical teacher he was eloquent, instructive, and when occasion called for it quite pathetic. His voice was good, though attenuated, penetrating, and sometimes rather sharp—his enunciation clear and distinct—his pronunciation constrained, and his emphasis, owing to his remarkable kind of punctuation, and a desire to be perspicuously understood, was studied, forced, and often inappropriate. In his lectures his diction was cacophonous and unpleasant.

"As a writer he is ingenious, rich in facts, profound in research, and always abounding in useful information. He wanted, however, in a great degree, a talent for generalizing. Hence his various works are characterized by an egregious want of method or perspicuous arrangement. His style, it must be confessed, is always diffuse, inelegant, and frequently tautological. As he never corrected what he once wrote, or at least but rarely, these defects in his composition were the natural consequences of his vehemence in writing. His punctuation is truly remarkable, and, for a man of his discernment and extensive reading, singularly incorrect.

"As a physician, he discovered a mind quick in discriminating disease, skillful in the application of appropriate remedies, though he certainly was a very cautious if not timid practitioner. No man read more extensively on the subject of diseases—in fact, he was deeply versed in pathological knowledge derived from books. As, however, his medical practice was never very extensive, his practical observations delivered in his lectures were strikingly marked with the evidences of overweening caution. Hence he recommended to his pupils, and always employed himself, unu-

sually small doses of medicine. He was, however, in the main, an observing and intelligent practitioner, and was remarkably assiduous in his attentions and soothing in his behavior to his patients.

"In figure he was tall and exceedingly well formed; in middle life he might be considered as having been handsome. His physiognomy was strongly expressive of intelligence, and his eye was remarkably fine and penetrating.

"In temperament he was irritable and even choleric. His spirits were irregular, his manners consequently variable, impetuous, vehement. These repeated vacillations between equanimity and depression were generally owing to the sudden and repeated attacks of his continual earthly companion—irregular gout.

"In familiar conversation he was often elegant, remarkably facetious, but never witty.

"As a parent he was kind, tender, and indulgent to a fault.

"He possessed some high virtues; among the most elevated of them was his unaffected love of country. Indeed, his patriotic feelings were not only strong, but frequently expressed with unreserved warmth."

A sketch of Barton, extracted from that by his nephew, was published in The Portfolio for April, 1816 (Philadelphia), and in an editorial note prefixed to it occurs this statement: "Our estimate, too, of the character of the deceased is somewhat different from that which has been formed by the author of this 'Sketch.' Dr. Barton was a very industrious man in the pursuit of science, and though we do not think that he has contributed much to enlarge its bounds, we are willing to believe that his collections will facilitate the labors of the student, to whom he has left a laudable example of active diligence and unwearied perseverance."

Dr. Barton was in correspondence with many prominent naturalists and physicians both at home and abroad. He established an enviable foreign reputation, as is attested by his membership in the Imperial Society of Naturalists of Moscow, the Linnæan Society of London, the Society of Antiquaries of Scotland, the Danish Royal Society of Sciences, and the Royal Danish Medical Society.

SPEAKING of travel as a means of learning, and of the great expansion that has been given to it of late years, Dr. B. W. Richardson calls such a mode one in which the surface of the earth becomes a living map, and the spoken languages the living grammars—a mode that must extend day by day as the mind yearns for more knowledge and the power that springs from it. No end is visible to him of the line of travel now inaugurated, and he has visions of university ships manned and supplied, instead of guns and fighting men, with professors, laboratories, observatories, and libraries, and in which voyages of research shall be made by all classes round the world.

PROFESSIONAL INSTITUTIONS.

XII.—EVOLUTION OF THE PROFESSIONS.

By HERBERT SPENCER.

THE saying that we can not put old heads on young shoulders, figuratively expresses, among other truths, the truth that the beliefs which in youth result from small information joined with undisciplined thought and feeling, can not, until after long years, be replaced by the beliefs which wider knowledge and better balanced mental powers produce. And while it is usually impracticable to ante-date the results of mental development and culture, it is also usually impracticable to arouse, during early stages, any such distrust of convictions then formed, as should be caused by the perception that there is much more to be learned.

This general remark, trite in substance though it is, I am prompted to make *à propos* of the profound change which study of many peoples in many places and times causes in those ideas of social organization which are current—ideas entertained not only by the young but also by the majority of the old, who, relatively to the subject-matter to be investigated, are also young. For patient inquiry and calm thought make it manifest that sundry institutions regarded with strong prejudices have been essential institutions; and that the development of society has everywhere been determined by agencies—especially political and ecclesiastical—of characters condemned by the higher sentiments and incongruous with an advanced social ideal.

One in whom aversion to autocratic rule is strong, does not willingly recognize the truth that without autocratic rule the evolution of society could not have commenced; and one to whom the thought of priestly control is repugnant, can not, without difficulty, bring himself to see that during early stages priestly control was necessary. But contemplation of the evidence, while proving these general facts, also makes it manifest that in the nature of things groups of men out of which organized societies germinate, must, in passing from the homogeneous to the heterogeneous, have first assumed the form in which one individual predominates—a nucleus of the group serving as a center of initiation for all subsequent steps in development. Though, as fast as society advances, and especially as fast as the militant type yields place to the industrial type, a centralized and coercive control, political and ecclesiastical, becomes less needful, and plays a continually decreasing part in social evolution; yet the evidence compels us to admit that at first it was indispensable.

This generalization, which we saw variously illustrated by political institutions and ecclesiastical institutions, we now see again illustrated by professional institutions. As the foregoing chapters have shown, all the professions originate by differentiation from the agency which, beginning as political, becomes, with the apotheosis of the dead ruler, politico-ecclesiastical, and thereafter develops the professions chiefly from its ecclesiastical element. Egypt, which, by its records and remains, exhibits so well the early phases of social progress, shows us how at first various governmental functions, including the professional, were mingled in the king and in the cluster of those who surrounded the king. Says Tiele:—

"A conflict between the authority of priest and king was hardly possible in earlier times, for then the kings themselves, their sons, and their principal officers of state were the chief priests, and the priestly dignities were not dissevered from nor held to be inconsistent with other and civil functions."

And again—

"The priestly offices were state functions . . . which did not differ at all in kind from that of commander of the troops, governor of a district, architect, and chamberlain. In fact, both kinds of office were, for the most part, filled by the same persons."

And since, as Brugsch tells us, "Pharaoh's architects (the Murket) . . . were often of the number of the king's sons and grandsons," we see that in the governing group the political, ecclesiastical, and professional functions were united.

No group of institutions illustrates with greater clearness the process of social evolution; and none shows more undeniably how social evolution conforms to the law of evolution at large. The germs out of which the professional agencies arise, forming at first a part of the regulative agency, differentiate from it at the same time that they differentiate from one another; and, while severally being rendered more multiform by the rise of subdivisions, severally become more coherent within themselves and more definitely marked off. The process parallels completely that by which the parts of an individual organism pass from their initial state of simplicity to their ultimate state of complexity.

Originally one who was believed by himself and others to have power over demons—the mystery-man or medicine-man—using coercive methods to expel disease-producing spirits, stood in the place of doctor; and when his appliances, at first supposed to act supernaturally, came to be understood as acting naturally, his office eventually lost its priestly character altogether: the resulting physician class, originally uniform, eventually dividing

into distinguishable sub-classes while acquiring a definite embodiment.

Less early, because implying more developed groups, arose those who as exhibitors of joy, now in the presence of the living ruler and now in the supposed presence of the deceased ruler, were at first simultaneously singers and dancers, and becoming specialized from the people at large, presently became distinct from one another: whence, in course of time, two groups of professionals, whose official laudations, political or religious, extended in their range and multiplied in their kinds. And then by like steps were separated from one another vocal and instrumental musicians, and eventually composers; within which classes also there arose subdivisions.

Ovations, now to the living king and now to the dead king, while taking saltatory and musical forms, took also verbal forms, originally spontaneous and irregular, but presently studied and measured: whence, first, the unrhythmical speech of the orator, which under higher emotional excitement grew into the rhythmical speech of the priest-poet, chanting verses—verses that finally became established hymns of praise. Meanwhile from accompanying rude imitations of the hero's acts, performed now by one and now by several, grew dramatic representations, which little by little elaborated, fell under the regulation of a chief actor, who prefigured the playwright. And out of these germs, all pertaining to worship, came eventually the various professions of poets, actors, dramatists, and the subdivisions of these.

The great deeds of the hero-god, recited, chanted or sung, and mimetically rendered, naturally came to be supplemented by details, so growing into accounts of his life; and thus the priest-poet gave origin to the biographer, whose narratives, being extended to less sacred personages, became secularized. Stories of the apotheosized chief or king, joined with stories of his companions and amplified by narratives of accompanying transactions, formed the first histories. And from these accounts of the doings of particular men and groups of men, partly true but passing by exaggeration into the mythical, came the wholly mythical, or fiction; which then and always preserved the biographico-historical character. Add to which that out of the criticisms and reflections scattered through this personal literature an impersonal literature slowly emerged: the whole group of these products having as their deepest root the eulogies of the priest-poet.

Prompted as were the medicine-men of savages and the priests of early civilized peoples to increase their influence, they were ever stimulated to acquire knowledge of natural actions and the properties of things; and, being in alleged communication with supernatural beings, they were supposed to acquire such knowl-

edge from them. Hence, by implication, the priest became the primitive man of science; and, led by his special experiences to speculate about the causes of things, thus entered the sphere of philosophy: both his science and his philosophy being pursued in the service of his religion.

Not only his higher culture but his alleged intercourse with the gods, whose mouthpiece he was, made him the authority in cases of dispute; and being also, as historian, the authority concerning past transactions and traditional usages, or laws, he acquired in both capacities the character of judge. Moreover, when the growth of legal administration brought the advocate, he, though usually of lay origin, was sometimes clerical.

Distinguished in early stages as the learned man of the tribe or society, and especially distinguished as the possessor of that knowledge which was thought of most value—knowledge of unseen things—the priest of necessity became the first teacher. Transmitting traditional statements concerning ghosts and gods, at first to neophytes of his class only but afterward to the cultured classes, he presently, beyond instruction in supernatural things, gave instruction in natural things; and having been the first secular teacher, has retained a large share in secular teaching even down to our own days.

As making a sacrifice was the original priestly act, and as the building of an altar for the sacrifice was by implication a priestly act, it results that the making of a shelter over the altar, which in its developed form became the temple, was also a priestly act. When the priest, ceasing to be himself the executant, directed the artificers, he continued to be the designer; and when he ceased to be the actual designer, the master-builder or architect thereafter continued to fulfill his general directions. And then the temple and the palace in sundry early societies, being at once the residence of the apotheosized ruler and the living ruler (even now a palace usually contains a small temple) and being the first kinds of developed architecture, eventually gave origin to secular architecture.

A rude carved or modeled image of a man placed on his grave, gave origin to the sculptured representation of a god inclosed in his temple. A product of priestly skill at the outset, it continued in some cases to be such among early civilized peoples; and always thereafter, when executed by an artisan, conformed to priestly direction. Extending presently to the representation of other than divine and semi-divine personages, it eventually thus passed into its secularized form.

So was it with painting. At first used to complete the carved representation of the revered or worshiped personage, and being otherwise in some tribes used by the priest and his aids for ex-

hibiting the tribal hero's deeds, it long remained subservient to religion, either for the coloring of statues (as it does still in Roman Catholic images of saints, etc.), or for the decoration of temples, or for the portraiture of deceased persons on sarcophagi and stelæ; and when it gained independence it was long employed almost wholly for the rendering of sacred scenes: its eventual secularization being accompanied by its subdivision into a variety of kinds and of the executant artists into correlative groups.

Thus the process of professional evolution betrays throughout the same traits. In stages like that described by Huc as still existing among the Tibetans, where "the Lama is not merely a priest; he is the painter, poet, sculptor, architect, physician," there are joined in the same individual, or group of individuals, the potentialities out of which gradually arise the specialized groups we know as professions. While out of the one primitive class there come by progressive divergences many classes, each of these classes itself undergoes a kindred change: there are formed in it subdivisions and even sub-subdivisions, which become gradually more marked; so that, throughout, the advance is from an indefinite homogeneity to a definite heterogeneity.

In presence of the fact that the immense majority of mankind adhere pertinaciously to the creeds, political and religious, in which they were brought up; and in presence of the further fact that on behalf of their creeds, however acquired, there are soon enlisted prejudices which practically shut out adverse evidence; it is not to be expected that the foregoing illustrations, even joined with kindred illustrations previously given, will make them see that society is a growth and not a manufacture, and has its laws of evolution.

From prime ministers down to plow-boys there is either ignorance or disregard of the truth that nations acquire their vital structures by natural processes and not by artificial devices. If the belief is not that social arrangements have been divinely ordered thus or thus, then it is that they have been made thus or thus by kings, or if not by kings then by parliaments. That they have come about by small accumulated changes not contemplated by rulers, is one of those open secrets which only of late have been recognized by a few and are still unperceived by the many—educated as well as uneducated. Though the turning of the land into a food-producing surface, cleared, fenced, drained, and covered with farming appliances, has been achieved by men working for individual profit not by legislative direction—though villages, towns, cities, have insensibly grown up under the desires of men to satisfy their wants—

though by spontaneous co-operation of citizens have been formed canals, railways, telegraphs, and other means of communication and distribution; the natural forces which have done all this are ignored as of no account in political thinking. Our immense manufacturing system with its multitudinous inventions, supplying both home and foreign consumers, and the immense mercantile marine by which its products are taken all over the globe and other products brought back, have naturally and not artificially originated. That transformation by which, in thousands of years, men's occupations have been so specialized that each, aiding to satisfy some small division of his fellow citizen's needs has his own needs satisfied by the work of hundreds of others, has taken place without design and unobserved. Knowledge developing into science, which has become so vast in mass that no one can grasp a tithe of it, and which now guides productive activities at large, has resulted from the workings of individuals prompted not by the ruling agency but by their own inclinations. So, too, has been created the still vaster mass distinguished as literature, yielding the gratifications filling so large a space in our lives. Nor is it otherwise with the literature of the hour. That ubiquitous journalism which provides satisfactions for men's more urgent mental wants, has resulted from the activities of citizens severally pursuing private benefits. And supplementing these come the innumerable companies, associations, unions, societies, clubs, subserving enterprise, philanthropy, culture, art, amusement; as well as the multitudinous institutions annually receiving millions by endowments and subscriptions: all of them arising from the unforced co-operations of citizens. And yet so hypnotized are nearly all by fixedly contemplating the doings of ministers and parliaments, that they have no eyes for this marvelous organization which has been growing for thousands of years without governmental help—nay, indeed, in spite of governmental hindrances. For in agriculture, manufactures, commerce, banking, journalism, immense injuries have been done by laws—injuries afterward healed by social forces which have thereupon set up afresh the normal courses of growth. So unconscious are men of the life of the social organism that though the spontaneous actions of its units, each seeking livelihood, generate streams of food which touch at their doors every hour—though the water for the morning bath, the lights for their rooms, the fires in their grates, the bus or tram which takes them to the City, the business they carry on (made possible by the distributing system they share in), the evening "Special" they glance at, the theater or concert to which they presently go, and the cab home, all result from the unprompted workings of this organized humanity, they remain blind. Though by its vital activities capital is

drafted to places where it is most wanted, supplies of commodities balanced in every locality and prices universally adjusted—all without official supervision; yet, being oblivious of the truth that these processes are socially originated without design of any one, they can not believe that society will be bettered by natural agencies. And hence when they see an evil to be cured or a good to be achieved, they ask for legal coercion as the only possible means.

More than this is true. If, as every parliamentary debate and every political meeting shows, the demands for legislation pay no attention to that beneficent social development which has done so much and may be expected to increase in efficiency, still more do they ignore the *laws* of that development—still less do they recognize a natural order in the changes by which society passes from its lower to its higher stages. Though, as we have seen, the process of evolution exemplified in the genesis of the professions is similar in character to the process exemplified in the genesis of political and ecclesiastical institutions and everywhere else; and though the first inquiry rationally to be made respecting any proposed measure should be whether or not it falls within the lines of this evolution, and what must be the effects of running counter to the normal course of things; yet not only is no such question ever entertained, but one who raised it would be laughed down in any popular assemblage and smiled at as a dreamer in the House of Commons: the only course thought wise in either the cultured or the uncultured gathering being that of trying to estimate immediate benefits and evils.

Nor will any argument or any accumulation of evidence suffice to change this attitude until there has arisen a different type of mind and a different quality of culture. The politician will still spend his energies in rectifying some evils and making more—in forming, reforming, and again reforming—in passing acts to amend acts that were before amended; while social schemers will continue to think that they have only to cut up society and re-arrange it after their ideal pattern and its parts will join together again and work as intended!

ACCORDING to the account of one of their days given by Mr. S. E. J. Clarke, the women of India lead as busy, useful, and responsible lives as any of those of Anglo-Saxon lands. As soon as a woman awakes, this author says, she recites her prayers, reverently salutes the pictures or sacred images in the room, and then kisses, in honor of Lukhi, the gold bangle on her wrist or the golden amulet on her arm, and, having done this, is ready to leave her bed. Next, she anoints her body with oil specially prepared for the purpose, and often delicately scented. The hair is then dressed and treated with oil, which among respectable people is prepared

in the house by the women themselves, and by processes which they keep to themselves. The lady is then ready for her bath, prior to which she uses *manjam*, a dentifrice often prepared from betelnut and finely aromatic. This also must be prepared at home; and the ingredients and scents used are never taken at haphazard, but are such as have a well-earned reputation for fitness for the uses to which they are applied. The bath having been taken, the ladies dress themselves, according to the season, in silken or woolen cloth; sprinkle Ganges water, or water made holy by an admixture of Ganges water, on their heads, and also on their beds. This part of the morning's duty is concluded by an obeisance to the sun. The serious part of the day's work begins after this. The cook room and household room are visited and the appointed prayers recited in them; the children and sick members of the family, if there are any, are attended to; the store room is opened and the kitchen utensils and other articles needed are issued to the servants; the special dishes to be made for the family, the sick, and the children are looked after; articles required from the bazaar are sent for; the stock of provisions on hand is examined; and a close watch is kept on all the operations of the household. A good housewife will often prepare some special favorite dish for her husband with her own hands; and, although she does not eat with him, will attend to his meals to see that he is well served. If they find any leisure after attending to their religious exercises and their duties, they are at liberty to occupy themselves according to their liking. Many of the elder women read in the Hindu classics, and the younger ones engage in fancy work. There are now, as there were in the olden times, women poets and writers whose work is of high merit, but not recognized by us because it is in the native languages. A fashion is setting in of spending some time at the piano or harmonium. Much attention is paid to the toilet and to the changes of dress for the various occasions of the day; and the day closes with evening worship and readings.

In the course of his experiments on the psychic development of a litter of puppies, Prof. Wesley Mills remarked that these animals, as well as those of several other kinds, even on their first day would not creep off from a surface on which they were resting if it was elevated a little distance above the ground. "When they approach the edge, they manifest hesitation, grasp with their claws or otherwise attempt to prevent themselves falling, and it may be cry out, giving evidence of some profound disturbance of their nervous system." But a water tortoise he had had for some years would at any time walk off from a surface on which it was placed. Prof. Mills accounts for the difference by supposing that land animals, depending on a firm substratum beneath them, have inherited "a sense of support"; while the amphibious tortoise is accustomed frequently to drop off from logs into water, and has not, or but little, "sense of support." Then, again, he finds the sense of support "well marked in birds that drop themselves into 'thin air.'" Birds, however, need the "sense of support" when depending on their feet quite as much as land animals.

The instruments used in the observations of the British Association's committee on earth tremors are so delicate that an angle can be detected corresponding with that subtended by a chord an inch long of a circle one thousand miles in radius.

Editor's Table.

A MODERN LIBERAL EDUCATION.

SUCH is the title of an exceedingly interesting, well-considered, and, in our opinion, weighty article contributed by Prof. Ladd, of Yale, to a late number of our excellent contemporary the Educational Review. The writer well remarks at the outset that the word "liberal" applied to education must imply some sort of differentiation. That differentiation, he shows, is not quantitative but qualitative. A "liberal education" does not mean a liberal supply of education; it means a liberalizing education, or, as he defines it, "that which makes the free mind, which furnishes the liberalizing culture of the trained gentleman." Prof. Ladd is quite aware that such a definition may strike not a few as invidious, but he is not disposed upon that account to alter the terms in which it is expressed.

We think he is right. There is an education which is imparted and accepted with a main, if not exclusive, view to its practical utility to the individual in enabling him to receive a better share than he otherwise might of the goods which society has to divide. And there is an education which aims at expanding his mental and moral powers, and fitting him to profit by the best that has been or is being thought and imagined and expressed in the world. The first, while imparting a measure of efficiency for everyday purposes, not infrequently instills an absolute distaste and repulsion for all higher uses of the intellect. The second develops both capacity and desire for intellectual and æsthetic pleasures, raises the mind above vulgar prejudices, and places the whole life of the individual on a higher level. The education that produces the latter effect even partially is so far a liberal education; and if the word "gentleman" is to have a real as opposed to a purely conventional significance, we may apply it with much propriety to one whose mind has undergone this liberalizing influence, and whose tastes and sympathies have thus been arrayed on the side of whatever helps to elevate and refine society. We fail to see that, in the true sense, there is anything antidemocratic in this; but if any think otherwise they are, of course, entitled to their opinion. Meantime, we feel sure that the higher education which we have thus imperfectly described, but which Prof. Ladd maps out for us in a very satisfactory and instructive manner, is a matter of vast importance for the progress of national culture and the right direction of our national life.

"A truly liberal education," Prof. Ladd observes, "includes as essential to it the prolonged and scholastic pursuit of three subjects or groups of subjects. These three are language and literature, mathematics and natural science, and the soul of man, including the products of his reflective thinking. Any culture," he continues, "which is markedly defective on any one of these three sides comes, so far, short of being liberal; of being, that is to say, the kind of culture which sets the mind most truly free, and which is most worthy of the cultivated gentleman in the nobler meaning of the latter word." It is an extremely wide scheme of education that is here laid out; and we may say of it, as is said of the strait gate and narrow way,

that "few there be that find it." We fully agree, however, with the writer that each of the groups of studies which he mentions contributes important and strictly indispensable elements to a truly liberal and humane education.

It seems hardly necessary to enforce the claims of language and literature as elements of culture. It is one of the chief triumphs of the human mind to have converted language, which primarily, no doubt, was merely a crude means for the expression of material wants, into a source—at least a possible source—of intellectual and æsthetic pleasure; and a great part of education may properly be directed to awakening the minds of the young to a sense of this great fact. The ancients fabled, and wisely, we think, that the Muses were daughters of Memory; in other words, that literature only arises when man has become able, through language, to contemplate his own thought, and live over again his past experience. It should therefore be a distinct aim in education to vindicate the claim of language to be something more than the servant and drudge of mankind, the minister to his lower necessities, or at best a buffoon for the amusement of his hours of hilarity. We should be taught to regard language as an associate, a friend, an equal, from whose intercourse we can gain refinement of thought, and almost every other form of intellectual benefit. We have sometimes thought that a certain classification might be made among people accordingly as they treat language as a menial, or as a friend and equal. With the former, language takes on the degraded form that might be expected from the rank to which it is relegated; and the work that it does is of the crude and inferior kind which might also be expected in such a case. To this class of persons those distinctions of thought which make up the pleasure and interest of intellectual life are nonexistent. In the most ordinary matters it is often difficult to get a definite statement from them, simply because they do not know what is definite and what is not; they have never put language to any sufficiently fine use to become conscious of the difference.

Prof. Ladd emphasizes the fact that it is the study of *language*, not of *languages*, which he holds to be essential in any system of liberal education. "It is undoubtedly," he says, "a very convenient thing in these days to speak in several of the principal forms of human speech; but it is not an essential, it is not even a very vital and impressive part, of a truly liberal education. The empty-headed hotel clerk, the boorish globe-trotter, the frivolous boarding-school miss, may have this accomplishment and not have the first rudiments of a liberal culture in language." Very much to the same effect does Ruskin express himself in his Sesame and Lilies. "If," he says, "you read ten pages of a good book, letter by letter —that is to say, with real accuracy— you are forever, in some measure, an educated person. The entire difference between education and non-education (as regards the merely intellectual part of it) consists in this accuracy. A well-educated gentleman may not know many languages, may not be able to speak any but his own, may have read very few books, but, whatever language he knows, he knows precisely. An uneducated person may know, by memory, many languages and talk them all, and yet not truly know one word of any —not even a word of his own." This is strongly said, but we are hardly disposed to dissent from it.

The principal value, in Prof. Ladd's opinion, to be derived from

the study of the classical languages, especially Greek, is that it facilitates and increases the enjoyment of all good literature. This is moderately stated and constitutes a more defensible position than the extreme advocates of classical studies sometimes take up. It seems to us to be greatly a question of time and opportunity. If one can grapple with a scheme of education including an accurate knowledge of the Greek language without being compelled to omit lines of study more necessary to place him — where every modern man should be—at the modern standpoint, we should say by all means let him study Greek and have his sense of beauty quickened by living intercourse with its wonderful literature, and his logical and critical faculties strengthened by investigation of its linguistic elements and grammatical forms. But we think it must be recognized that, as the claims of *modern* culture become greater, the number of those who will find time and opportunity for this will become more and more restricted.

On the subject of mathematics and the physical and natural sciences, the professor's views are eminently reasonable. He does not claim too much for mathematics as a training in deductive reasoning; he considers that its educational value lies rather in the alertness it bestows in attacking and solving problems. "For is not life," he asks, "one prolonged succession of problems that demand to be solved? To be sure," he adds, "most of the problems are not of the mathematical order; but it is a thoroughly good thing for a man not to be a coward or a sluggard when he is brought face to face with any hard problem." Before the liberalizing power of mathematics can be fully experienced, it is necessary to have attained in the first place "a certain amount of free and joyful movement in the handling of mathematical symbols and formulæ"; and, in the second, "a certain grasp upon the beautiful ideas and the wonderful laws which these symbols and formulæ represent." Mathematics, however, deals only with abstract truths: for that knowledge of the laws of Nature which is an essential and most important part of modern liberal culture we must have recourse to natural science. Here Prof. Ladd makes a distinction similar to that which he made in speaking of language. He postulates a training in *science* rather than in sciences. This training, he explains, "implies such a course of study as will impart a conception of what is now understood by the term science, and of the recognized method of scientific investigation common to all the natural sciences." A remark which follows contains much truth: "How often does one meet men of fine literary culture who show no little bigotry, and commit not a few important mistakes, because they simply do not know what science really is!" In answer to the question how much of scientific knowledge is necessary for a liberal education, Prof. Ladd replies: "Enough to give the student a firm grasp on those fundamental physical principles upon which the world of things is built, and enough of the pursuit of some form of descriptive natural science to impart the training of the powers of observation and the habit of properly connecting newly observed natural objects with groups of similar objects known before." We should be disposed to add—though perhaps the professor might claim that it is implied in what he himself has said: Enough to bring clearly and effectually home to the mind what is understood by scientific evidence, and to

produce a proper attitude of mind—according to the evidence proffered—toward every proposition or doctrine presented for acceptance.

We can not follow Prof. Ladd into the third division of his subject, namely, the claims of a scientific psychology to be regarded as a necessary part of a liberal education; we can only say that here too he seems to us to be on solid ground. We agree with him also when he says that "the condition of public education in the United States is far from satisfactory at the present time." There are many useful thoughts in his article on which we have not touched; and if we leave it for to-day it is "without prejudice" in case we should wish to return to it on some other occasion.

NECESSITY.

AMONG the ancient Greeks the idea of necessity, or as they called it *ananké*, assumed a certain religious character. It might bring evil and pain, but, in so far as it was an integral part of the order of things, it claimed a pious submission. We sometimes think that there is room for a similar conception in modern times. It is not uncommon to find people railing at the world as evil, because this or that is not arranged according to ideas of what is right, because *necessity* sets limits to human action and happiness. What the Greeks felt was that *ananké* could not be got rid of, and that the best thing we could do was to agree with it, and in a manner reverence it. The Greek was right: get rid of necessity in one form, and it immediately reappears in another; in some form man must face it and submit to it.

Socialist writers do not appear to be at all of this way of thinking. They have a noble zeal for remedying evils, but they do not seem to allow anything for the conditions which Nature itself imposes. Thus Prof. Albion Small, of Chicago, finds much to object to in the fact that "if a weaver or switchman loses his job, no law compels another employer to hire him." He adds that "few men outside the wage earning class have fairly taken in the meaning of this familiar situation." What we should like Prof. Small or some one else to do is to figure out a situation in which, a weaver or a switchman having lost his job, somebody else *would be* obliged to hire him. It would really be interesting to have this worked out; our impression is that Prof. Small, or whoever undertook the task, would find himself bumping up against old "ananké" in an altered phase. Everybody in that case would want to be the man who could get a situation—of course, a satisfactory one—for the asking; nobody certainly would care to be the provider of situations to his fellow-citizens. We are far from saying that there is not a vast amount of hardship in the world, and much of it of a kind which in no way benefits those who have to endure it, as of course some hardship undoubtedly does. But we want to see a way out that will not cut the nerves of industry and make self-reliance a forgotten virtue. We want to see a way out that will not lessen the sense of individual responsibility or make a man less a man. Show us such a way, and we shall gladly lend every effort in our power toward its realization.

Prof. Small seems to think that the occupation of the land under private tenure is largely responsible for the helpless condition of a portion of society; but has he or has any one else ever worked out in all its details a different scheme? Would poverty always be alleviated by a gift of land, especially if the land

so bestowed could not be sold? If it was agricultural land it would have to be either improved or unimproved: in either case capital, not to mention industry, would be required to work it; and in the second case to give away the improvements would be to give away the labor of other men. Make land absolutely unsalable, and the economic operations of the world would be impeded in the most serious manner. The more, for our own part, we look into these questions, the more we are driven back to the conviction that the way out which is so much desired lies in the improvement of individual character with consequent increase of individual power and better adaptation to surrounding conditions. As it is, we find that the well-developed individualities can take care of themselves pretty well; they have the power of adapting themselves to their surroundings, and taking so useful a part in the world's work that, even under the much-abused capitalistic system, they thrive very well. The problem is to make more sound individuals; and that problem does not seem to be in its nature insoluble—therein differing from some that are set by social reformers.

Then, is this your way, some one may ask, for getting rid of *ananké*? By no means: it is our way for making the best of it. In every well-balanced mind the thought of necessity is habitually present, calling forth efforts of self-restraint which tend to conserve and consolidate the individual's happiness and well-being. We contemplate, therefore, a constant recognition of necessity, but a recognition which enables a man to meet it on ground more or less of his own choosing, and not as the Nemesis of error and weakness or the ironic destroyer of futile schemes and baseless visions.

RÖNTGEN TO THE RESCUE! OR, A NEW CHANCE FOR ABSURDITY.

Our thoughtful contemporary, The Nation, is quick to point out the abuse which absurd people of all kinds will make of Prof. Röntgen's discovery of the peculiar action of the so-called X rays. "The stubborn power," it says, "of ignorance to wrest every new scientific scripture to its own destruction is already beginning to display itself in connection with the wonderful Röntgen discovery. Quack doctors are quick to say, 'Aha! this shows that our electric rings and mesmeric belts and psychic brushes and combs are just what we claim them to be.' The mysterious cathode rays, invisible but powerful, will doubtless renew the faith of many a despairing brother who carries a potato in his pocket for rheumatism. What the theological apologists will argue from the apparent need of readjusting the theory of light, those of our readers who are skilled in their methods of reasoning can guess. The Mosaic authorship of the Pentateuch, the reasonableness of prayer for rain, the duty of instantly subscribing both to the creed and for the religious weekly of the able editor making the argument, will be among the very least of the things conclusively proved by the new photography."

Such is the penalty for every new discovery of Science. By one of the oddest perversions of the reasoning faculty which it is possible to conceive, the very advances made by Science are converted into so many reasons for disparaging her authority, and drawing conclusions in favor of notions for which there is no evidence at all. Science did not know this before: *ergo*, Science is fallible; *ergo*, this or that shaky doctrine is so far confirmed. Such is the logical process, and possibly there is some

mysterious benefit in it for a certain class of minds. If it pleases them, it does not do much harm to Science, which, as The Nation says, has such an army of workers at its disposal as the world never saw before.

Scientific Literature.

SPECIAL BOOKS.

WE often see allusions to the triumphs of the inventor, and descriptions of single achievements are constantly being presented by the periodical press, but it is a long time since a goodly number of them have been brought together systematically as in the volume now before us.* The author has undertaken to present in popular language the chief results obtained within recent years by the arts of engineering and mechanics, together with suggestions as to what the future may bring forth, these suggestions being based upon the lines of research on which great minds are known to be pushing forward. When one stops to enumerate the notable inventions which the average city dweller makes use of in his daily life, a feeling of wonder at their array can not be repressed. On his breakfast table is sugar which has been extracted and purified by machinery; if it is warm weather, perhaps some of his food has been kept overnight by machine-made ice; either during or after the meal he reads a newspaper that may have been put in type and was certainly stereotyped and printed by machinery; he sees by a watch whose parts have been turned out by delicate machines that it is time to take a car propelled by a machine in a power house several miles away or by a storage battery and ride to the towering steel structure in which his office is. If he is a suburban dweller, he may cross a bridge of imposing span, and wish for the time when flying machines are practicable enough to shorten his journey. He ascends by an electric elevator to the 'teenth or twentieth story of the office building, which is perhaps partly lighted through glass containing wire netting. His business involves the sending and receiving of many telegrams which are printed by the receiving instruments. He goes home in the afternoon early enough to take a spin on his stanch nineteen-pound bicycle, or a trial ride with the agent of a motor carriage, or a sail in his electric launch; for a submarine boat he does not yearn. In the evening he reads his magazine, illustrated with photo-engravings, by light from electricity, or from enriched coal gas in an improved burner, or possibly from the product of the oil well. Other inventions, with which he does not come into immediate contact, prepare articles for his use or aid in transporting them to him. Among these may be mentioned mining, ore-concentrating, and coal-handling machinery, the steel converter, the spectroscope, the testing machine, various machine tools, compressed-air mechanisms, the plant utilizing power from Niagara, tunnels, canals, and the ocean steamer. All these and more are described in Mr. Cochrane's book, and the author is quite resigned to the idea of a reader of some future gen-

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* The Wonders of Modern Mechanism. By Charles Henry Cochrane. Pp. 402, 8vo. Philadelphia: J. B. Lippincott Company. Price, $2.

eration smiling at the smallness of the achievements which he is able to chronicle at the end of the nineteenth century. The volume is well illustrated and printed, but lacks an index.

As "down East" recedes before him who journeys toward the rising, so does "out West" elude him who follows the setting sun. The district long known as the West is east of the present geographical center of the United States, and the name must now be applied to a region far beyond. In order to preserve a knowledge of the real West a series of books under the general title of The Story of the West has been planned by Mr. Ripley Hitchcock, which will present the typical characters who made the life of this wonderful region what it was. It is fairly safe now to locate the West, for the Pacific Ocean forms a barrier which it can not pass. Eastward Mr. Hitchcock places its limit at the Missouri River. The first book of the series is devoted to the aboriginal inhabitant.* Its prime object is to show to the reader the Indian's daily life. As the editor of the series truly says: "Mr. Grinnell takes us directly to the camp fire and the council. He shows the Indian as a man subject to like passions and infirmities with ourselves. He shows us how the Indian wooed and fought, how he hunted and prayed, how he ate and slept—in short, we are admitted to the real life of the red man, and as we learn to know him we discard two familiar images: the red man of the would-be philanthropic sentimentalist, and the raw-head-and-bloody-bones figure that has whooped through so many pages of fiction." Mr. Grinnell's style is far removed from that of the dry-as-dust piler-up of facts. For vividness and movement his book is well termed a "story," but it gives a much more realizing sense of the Indian's ways than half a dozen tales of Indian adventure of equal length. Thus, in telling about the Indian's recreations, it describes the scene in and about a camp on a day when no serious work is in hand, giving the amusements of the men, the women, the boys, and the younger children, even down to the mischief of whacking the sleeping dogs. In telling of his war customs, Left Hand or Four Bears is followed upon the trail, and tales of battle told to the author by Indians are freely used. The same method is followed in describing the red man's home life, modes of subsistence, marriage customs, hunting, religion, etc. There is also an interesting chapter showing how the Indians were impressed by the coming of the white man, and in an appendix the distribution of the Indian tribes of North America is set forth. It will thus be seen that the book has no small anthropological value. The volume is fully illustrated and is attractively printed and bound. Future volumes in the same series may be expected to depict the life of the explorer, the soldier, the miner, the trapper, the cowboy, and perhaps other characteristic western types.

MR. *Percival Lowell*, who once told us about An Unexplored Corner of Japan, now has something to tell about a still less explored region. He has been making a polar expedition and other explorations on *Mars*,† not quite at the usual long range, for his observations were made during ten

* The Story of the Indian. By George Bird Grinnell. Pp. 270, 8vo. New York: D. Appleton & Co. Price, $1.50.

† Mars. By Percival Lowell. Pp. 228, 8vo. Boston: Houghton, Mifflin & Co. Price, $2.50.

months of 1894 and 1895, which included the time of the latest opposition of the planet. These observations were made from the Lowell Observatory, which was established at Flagstaff, Ariz., and Prof. W. H. Pickering and Mr. A. E. Douglass were associated with Mr. Lowell in making them. In this book Mr. Lowell gives first the general appearance of Mars, its size, orbit, etc. From measurements made at Flagstaff, the diameter of the planet was determined as 4,215 miles, and its polar flattening as $\frac{1}{170}$ of its equatorial diameter. The presence of an atmosphere is well established, and good fortune enabled measurements of it to be obtained. It appears that the atmosphere is thinner by half than the air upon the summit of the Himalayas, and in constitution does not differ greatly from our own. The ice cap about the south pole gradually dwindled away as the Martian summer advanced, and finally disappeared altogether. This was the occurrence—the first on record—which enabled the planet's atmosphere to be measured, and which gave additional information as to the presence and distribution of water upon its surface. Mr. Lowell gives us a notably full exposition of areography, or the geography of Mars, based upon a series of twelve views made by him, and reproduced in the book, which together represent the whole surface of the planet visible on the first of August. He describes its continents and peninsulas, its seas and gulfs, and especially its famous canals, which make Mars a very Holland of planets. These straight or evenly curved lines he deems it very probable are irrigating ditches, made to control the water from the annual melting of the polar ice caps, for there seems to be no other way of distributing the planet's scanty supply of moisture. Various other features of the present and probable future condition of Mars are set forth in this attractive volume. At the end we have a map of its whole surface on the Mercator projection, followed by a list of areographic names and a general index.

THE second volume of Messrs. *Groves* and *Thorp's Chemical Technology** consists of chapters by various authors on the fats and oils used for illuminating, and on the lamps in which these substances are burned. The first section, in which the animal and vegetable illuminating substances are described, and the modes of testing them are given, is by William Y. Dent. The attitude of the uncultivated Britisher toward the United States is unpleasantly evident in several of this writer's remarks about American products. The methods and apparatus employed in the extraction of stearin from various fats, and for distilling and pressing it, are described by John McArthur. His text is accompanied with figures of the autoclaves of de Milly, Morane, and Droux, the apparatus of Tilghman, Hugues, and Michel for the decomposition of fats by water, two forms for the distillation of fatty acids, a hydraulic press for cold pressing, and one for hot pressing. L. Field and F. A. Field describe the making of candles from the material thus prepared, giving many illustrations of the machines employed in the industry. The largest contribution to the volume is made by Boverton Redwood, who furnishes the sections on petroleum and lamps, and, in conjunction with D. A. Louis, that on miners' safety lamps. Mr. Redwood gives brief accounts of the rise of the petroleum industry in the

* Chemical Technology. Edited by Charles Edward Groves and William Thorp. Volume II, Lighting. Pp. 898, large 8vo. Philadelphia: P. Blakiston, Son & Co. Price, $4.

United States, Russia, and other countries, and describes at some length the methods of drilling and operating wells in the United States, with notes on the practice followed elsewhere. The American and the Russian methods of refining petroleum, the distilling of shale oil, which is an important industry in Scotland, and the manufacture of paraffin, are then described. All these accounts are fully illustrated by figures of apparatus, and many tables of production, analyses, etc., are given. In this section there is an interesting sketch of ozokerite mining in Galicia. Mr. Redwood's chapters on lamps are of much popular as well as technical interest. His treatment is largely historical, a few lamps of the ancients being included, and the dates and numbers of the patents issued for the modern forms being given. Sponge lamps, blast lamps, and lamps for railroad cars and ships are described, as well as the more familiar forms. In this section something about the making of oil gas and air gas is also told. The subject of miners' safety lamps is treated in much the same way. These two sections contain over two hundred of the three hundred and fifty-eight figures in the volume. Gas and electric lighting are left for the next volume of the series.

GENERAL NOTICES.

UNDER the editorial care of Prof. C. Lloyd Morgan has appeared the second volume of the work upon which Prof. *Romanes** was engaged at the time of his death. The present volume is mainly devoted to a consideration of those post-Darwinian theories which involve fundamental questions of heredity or utility. The chapters dealing with heredity are almost exclusively concerned with Prof. Weismann's views as to the inheritance of acquired characters. Prof. Romanes presents evidence both for and against such inheritance, and while he agrees with Galton in largely diminishing the potency of the Lamarckian principles, he can not go so far as to abolish it as Weismann does. In the chapters grouped under the head of utility he vigorously opposes the doctrine that all species must necessarily be due to natural selection, and therefore must severally present at least one adaptive character as held by Huxley, and he finds still less tenable the more extended form of the same doctrine held by Wallace. Regarding the question as purely one of reasoning, he combats it by argument without appeal to facts. In an appendix he discusses some side issues connected with the principle of panmixia, and in another he states more fully than in the body of the book the opinions of Darwin and Huxley on characters as adaptive and specific. The volume contains a portrait of the author as frontispiece and several figures in the text.

Prof. *Tarr's* new book on physical geography* has the character of those recent treatises which have appeared under the title of physiography. It is not a description of the topographical features, climate, animal and vegetable productions, etc., of the several regions of the earth in the familiar atlas form, accompanied by large maps, but rather a depiction of typical forms assumed by land and water, with accounts of the processes that have produced them. It is thus largely devoted to the dynamic side of its field. After a short description of the earth as a planet, the author sets forth the usual and the occasional phenomena of the atmosphere, and shows how these conditions affect the geographic distribution of animals and plants. Three chapters are given to the form and characteristics of the ocean, leaving about half of the book to the land. In this last part especial attention is given to such agencies of change as weather, streams, glaciers, waves, and the internal heat of the earth,

* Darwin and after Darwin. By the late George John Romanes. Vol. II. Pp. 344, 12mo. Chicago: The Open Court Publishing Co. Price, $1.50.

* Elementary Physical Geography. By Ralph S. Tarr. Pp. 488, 12mo. New York and London: Macmillan & Co. Price, $1.40.

and to the various features of the land produced by them. There is also a chapter on the reciprocal influences of man and Nature, and one on economic products. Most of the examples are drawn from the United States. There are four appendixes devoted respectively to meteorological methods, topographic maps, suggestions to teachers, and questions on the text. The volume is copiously illustrated with photo-engravings of varying degrees of distinctness, maps and diagrams, and a list of reference books is given at the end of each chapter.

In his *First Year in French*, designed for young pupils (American Book Co., 50 cents), *L. C. Syms* has aimed to unite the conversational and the translation methods of teaching the language. Directions for the use of the book are given, and French-English and English-French vocabularies are appended.

The same publishers have issued the first part of a series of simple French readings under the title *Contes et Légendes* (60 cents), by *H. A. Guerber*, author of Myths of Greece and Rome, etc. With the exception of the first one of the series these stories are not likely to be known to American pupils. There is a vocabulary.

The technique of the organic chemical laboratory is a considerable and somewhat intricate body of knowledge. Through oral instruction the student becomes acquainted with those devices and forms of apparatus required for common operations, getting, where there is a choice of processes, the one which his instructor has had the best success with. When he comes to practice his profession he gathers others as he has occasion for them from the various journals for the publication of chemical researches, and sometimes fails to find what he wants at the right time. In order to make such knowledge conveniently accessible, Dr. *Lassar-Cohn*, of Königsberg, several years ago prepared a *Laboratory Manual of Organic Chemistry*, from the second edition of which Prof. *Alexander Smith*, of Chicago, has made a translation (Macmillan, 8*s.* 6*d.*, $2.25). It groups processes generally applicable under such heads as crystallization, distillation, extraction, determination of melting points and of molecular weights, sealed tubes, and sublimation. In this part of the work a large number of pieces of apparatus are described and some forty are figured. About three fourths of the volume is devoted to special processes of condensation, the preparation of esters, halogen compounds, nitro-derivatives, and other substances, oxidation, reduction, saponification, etc. There is also a chapter on organic analysis. The volume is indexed and has a table for finding the year of any volume of the chief chemical journals.

From the Department of the Interior we have received Volumes XXIII and XXIV, consisting of monographs from the United States Geological Survey. The first of these deals with the *Geology of the Green Mountains in Massachusetts*. The general structure and correlation is first considered, and then Hoosac Mountain and Mount Greylock are taken up individually. There are many valuable plates and maps to illustrate the text. Volume XXIV is entitled *Mollusca and Crustacea of the Miocene Formations of New Jersey*. The work seems to have been done with care, and the relation of the paleontology of New Jersey to the structural conditions prevailing in other parts of the United States makes it of national interest. Unusually good illustrations are numerous.

Volume XIV, for 1894, of *The United States Fish Commission Bulletins*, contains, as these publications regularly do, the results of a large number of careful observations on the life history and habits of American fish in all parts of the country. Among many interesting papers we especially note the following: Notes on Two Hitherto Unrecognized Species of American Whitefishes, by Hugh M. Smith, M. D.; On the Appliances for collecting Pelagic Organisms, with special reference to those employed by the United States Fish Commission, by Z. L. Tanner, United States Navy; Feeding and Rearing Fishes, particularly Trout, under Domestication, by William F. Page; and A Statistical Report on the Fisheries of the Middle Atlantic States, by Hugh M. Smith, M. D.

The Stark Munro Letters, by *A. Conan Doyle*, is an attractive little volume of 385 pages (Appletons, $1.50). It is an account of the troubles and difficulties which a young physician, Dr. Stark Munro, had to overcome at the outset of his career. The story is told in a series of letters from the

young doctor to one of his school-fellows who has emigrated to America. The central figure in the tale is a man named Cullingworth, who was a schoolmate of the two correspondents, and whose career is followed to the end of the book, at which point he is on the eve of departing for South America with a shipload of spectacles for the natives. His strange, almost paradoxical character makes a curious picture, and leads to some surprising performances, both in connection with his private life and in his profession of medicine, where he comes to be considered by his associates a mere charlatan.

Under the title *The Forces of Nature*, brief popular accounts of the solar system, the air, sound, light, heat, and electricity have been brought together in a volume by *H. B. Harrop* and *Louis A. Wallis* (the authors, Columbus, O., $1.25). It is not a book for study, but is intended rather to give an understanding of the chief laws and phenomena of science to persons who have been occupied with their respective callings to the exclusion of scientific reading.

Something widely different from the ordinary text-book is the *Working Manual of American History*, by *William H. Mace* (Bardeen). It consists, first, of a list of topics, extending in time from the opening up of America to Europe down to the reconstruction of the South, with references to standard historical works. This matter, which occupies about one third of the volume, is followed by extracts from documents covering about the same period, accompanied by questions.

A text-book for normal schools, under the title *Psychology in Education*, has been prepared by Prof. *Ruric N. Roark* (American Book Company, $1). The author arranges the mental faculties in classes and subclasses, and bases his descriptions on this classification. In accordance with the purpose of the book he points out the importance of training each of the faculties, and shows how knowledge of the operations of the mind can be applied in education. Prof. Roark is not one of those instructors who leaves his students to balance conflicting views, even in so young a science as psychology. All his statements are definite and decided. He does not hesitate even to set bounds to the further progress of knowledge, nor to state his view in certain controverted matters as if there were no other. Thus, in the chapter which he gives to the "physical basis" of mind he says: "All that is *known* regarding the subject may be stated fully in one paragraph: Mind, as we know it, rests upon a physical basis, which acts upon mind, and upon which mind acts. What the connection is between mind and that physical basis, or how this connection is made and maintained, is not known, and most probably never will be known." Here and elsewhere he shows that he expects little from the "new school" of physiological psychologists. He has much more sympathy for child-study, and points out methods of pursuing it. His views as to the comparative worth of many of the usual school studies are also freely expressed.

The recently published account of the Myths of Greece and Rome, by *H. A. Guerber*, has been followed by *Myths of Northern Lands*, by the same author (American Book Company, $1.50). The ancient tales which are the common heritage of the English and other branches of the Germanic stock are here simply told, with the embellishment of poetical quotations and of engravings from paintings representing the personages and scenes of the myths.

The several Webster's School Dictionaries have been revised to conform to the International. The largest of the four, *Webster's Academic Dictionary* (American Book Company, $1.50), now contains 736 pages, being 150 more than in the last edition, while the illustrations have been increased from 350 to over 800. The body of the book is now arranged in two columns, instead of three, and the supplementary matter comprises a guide to pronunciation, rules for spelling, lists of affixes, abbreviations, proper names, words and phrases from foreign languages, and arbitrary signs, a classification of languages, and a brief mythological dictionary.

The University of Chicago Press has undertaken the issue of *The American Journal of Sociology*, a bimonthly magazine, to be edited by Prof. *Albion W. Small* and his associates in the department of sociology in the University of Chicago. The journal

starts in a quiet and dignified way. There was evidently no effort to go far afield for conspicuous contributors to the first number, six of its seven articles being contributed by Chicago professors. It is announced, however, that some of the most eminent sociologists in the United States and Europe will be advisory editors and contributors. We are glad to see the lack of a journal for America in this field supplied. The new magazine can be productive of much good, both to its readers and to its contributors—to the latter, by forcing them to state their ideas so as to be proof against the criticism which never dares raise its head in the professor's lecture-room.

Two pamphlets on American currency, either of which may be taken as an antidote to the other, have come to hand within the same month. In one, *The Financial Question*, a large number of considerations adverse to the free coinage of silver are presented by *Charles S. Ashley* in short, disconnected discussions or quotations (the author, Toledo, O.). A feature of the publication is a series of diagrams, in which many of the author's facts and estimates are presented in a graphic way. Various considerations on the opposite side of the question are presented by *Mason A. Green* under the title *Are we Losing the West?* (C. E. Brown, Boston, 10 cents). If the Ohio man can be taken as speaking for the West, the anxiety of the Massachusetts man is misdirected.

Among the bulletins issued by the University of the State of New York in 1895 was a revision of the *Academic Syllabus*, or statement of the requirements for the examinations conducted by the university. It contains the changes determined upon since the last revision, in 1891, the most important of which tend toward more thorough work in English and history. Another bulletin is devoted to the *Tenth Annual Conference of Associated Academic Principals*, in which discussions on a number of subjects interesting to teachers are reported. Extension Bulletin No. 9 consists of brief descriptions of the *Summer Schools* of the United States and of a few abroad.

Guides to genuine science teaching are steadily increasing in number. A little manual which well embodies the spirit of such instruction is *Practical Proofs of Chemical Laws*, prepared by *Vaughan Cornish*, of Owens College (Longmans, 2*s.*, 75 cents). It is a course of some twenty experiments on the combining proportions of the chemical elements, with full working directions, and a statement in each case of what the results mean. The results of historic experiments and of students' work are frequently cited to show what approximation to accuracy should be expected.

A Naturalist in Mexico, by *Frank C. Baker* (David Oliphant, Chicago), is the account of a winter's trip to Cuba, northern Yucatan, and Mexico. The expedition was undertaken under the auspices of the Academy of Natural Sciences of Philadelphia, its object being to collect data and specimens illustrating the fauna, flora, and geology of Yucatan and southern Mexico. The text is a combination of narrative, science, and history. Some of the descriptive writing is very well done, and while the book is perhaps not exhaustive, the whole trip only lasting a trifle over three months, it is extremely interesting. Illustrations from photographs, taken by the party, together with sketches made by the author, are quite numerous; and there are also figured a number of new species of mollusks which were discovered by the expedition.

A Laboratory Course in Experimental Physics, by *W. T. Loudon* and *J. C. McLennan* (Macmillan, 8*s.* 6*d.*, $1.90), was prepared, say the authors, to assist them in handling large laboratory classes in which they had found it very troublesome and slow to give the necessary detailed explanation of the experiments to each individual orally. The book contains a series of elementary experiments adapted for students who are not familiar with higher mathematical methods, which have been arranged as far as possible in order of difficulty. There is also an advanced course of experimental work in acoustics, heat, and electricity, which is intended to follow the elementary course.

The *Eleventh Annual Report of the Commissioners of the State Reservation at Niagara* contains, besides the detailed account of the work of the commission for the year 1893–'94, an interesting paper on the Duration of Niagara Falls and the History of

the Great Lakes, by J. W. Spencer. The computation of the age of the river is made by the measured rate of recession of the falls during forty-eight years, and leads to the conclusion that the falls are 31,000 and the river 32,000 years old. At the estimated rate of terrestrial elevation in the Niagara district, it will require between 5,000 and 6,000 years for a sufficient rise to divert the waters of Lake Erie through the divide at Chicago, and thus end the falls. Mr. Spencer's paper has been reprinted separately. In the commissioners' report considerable space is given to an account of the efforts which they have made to protect the beauty of the falls and its surroundings from destruction through commercial enterprise. They have not as yet been able to influence the State Legislature in any effective way, and, while the water privileges on the Canadian side are a source of revenue to Canada, the American privileges are being legislated away for nothing, and, what is far worse, there seems great danger of serious injury to the natural features of the falls and the park.

A picturesque sketch of *Constantinople*, has been written by *F. Marion Crawford* and copiously illustrated by Edwin L. Weeks (Scribners, $1.50). The author finds much that is attractive in this unique city and its environs while the Turk appears to him a much better specimen of humanity than the wily Greek or Armenian will admit.

The *Outline Study of United States History*, prepared by *Harlow Godard* (Bardeen, 50 cents), consists of a list of topics extending from the discovery of America to Cleveland's second administration, with directions for studying, lists of reference books, and reviews.

The *Report of the United States Life-saving Service for 1894* presents the usual record of laborious and often heroic service. The year was one of violent tempests and many disasters, while timely warning signals were given to over two hundred vessels, a large portion of which undoubtedly would have otherwise met with destruction. An examination of this record should convince any one that the maximum pay of sixty-five dollars a month ought not to be withheld from those surfmen who are employed for more than eight months in the year. The report contains a list of life-saving medals awarded by the Secretary of the Treasury since 1874. Several names of New York policemen appear in this list, but none of those of any other city, which apparently gives support to the claim that New York's force is "the finest."

Reconstruction during the Civil War, by *E. G. Scott* (Houghton, $2), is a political history of the so-called period of reconstruction. The years during which the process of renewal of the former Confederate States was taking place are called in popular speech the reconstruction period, and this name refers somewhat indefinitely to the time occupied by the single term of President Johnson and the succeeding two terms of President Grant. The author begins in Revolutionary times and, roughly sketching the origin, growth, and history of the various political parties up to the time of the civil war, gives the reader a clear notion of the causes, both immediate and remote, which led up to this event. Then he takes up the proposed methods of reconstruction, and gives an account of the disagreement between Congress and the President on this question. The last five chapters contain accounts of reconstruction as carried out in Tennessee, Arkansas, and Louisiana, and a discussion of what constitutes a State of the American Union.

Dr. *M. L. Holbrook* has issued a volume on the *Physical, Intellectual, and Moral Advantages of Chastity* (Holbrook & Co., New York, $1), in which he exhorts his readers to live a chaste life, and depicts the beauty and nobleness of chastity with the aid of many quotations from poets and essayists. He also denies the reality of alleged disadvantages of chastity.

Weather and Disease, by *A. B. MacDowall* (The Graphotone Co., London, 2*s.* 6*d.*), is the title of a book on the influence of weather on health. This is a subject which has received too little attention from physicians, and yet every one knows how immediately a sudden change in the weather affects even a healthy person's spirits and bodily well-being; how much more susceptible must a broken-down, or even an only temporarily weakened system, be to such changes! The primary

object of this book is to give an idea of the way in which certain elements of our weather and the mortality from some well-known diseases have varied in recent years. The mode of exposition adopted is that of graphic curves. For instance, on page 57, a whooping-cough table is given which covers the period from 1837 to 1894. A curve is plotted from a careful study of the mortality statistics, thus giving a picture which accurately represents the variations of the death-rate in this disease during practically the last fifty years; this table can then be compared with a similarly constructed one, representing the variations in temperature and rainfall for the same period, and the relation between the two series made out.

The sudden rise into prominence of massage as a therapeutic agent has already caused the growth of a quite extensive literature on the subject. The last volume to reach us, *The Practice of Massage*, by *A. Symons Eccles* (Macmillan, 7*s.* 6*d.*), is in a general way a treatise on the more recent as well as the earlier contributions to our knowledge of the effects, uses, and limitations of massage, so far as they have appeared to be fairly well established by actual results. The author has besides, however, set down the record of his own personal observation and practice. The appropriate manipulations for the various diseases are given in detail, and the book is closed with a very good bibliography of the subject.

With the beginning of the new year and of its fourteenth volume, the *Pharmaceutische Rundschau* became the Pharmaceutical Review, and was removed to Milwaukee. It will also henceforth be printed chiefly in the English language, although articles from German contributors that would suffer by translation will continue to appear in German, and sometimes in both languages.

The embodiment of a vivid narrative and the dress of a handsomely printed and illustrated volume have been provided by *John Uri Lloyd*, of Cincinnati, for the philosophical reflections and scientific hypotheses that a lifetime has matured in his mind. In a preliminary statement Prof. Lloyd says that his study of the material (he ranks high among American pharmaceutical chemists) has discredited materialism for him, and the leading ideas of his book, to which he has given the anagrammatic title *Etidorhpa*, are that "force and spirit are neither less real than the other, and that matter is not more substantial than either," while pure and noble love is man's highest good, whether here or hereafter. The story reminds one strongly of Jules Verne. It describes a journey underground in the care of an eyeless guide, among colossal fungi, monstrous cubical crystals, hideous reptiles, and beautiful flowers, over crags and precipices and across a crystal lake, until the "end of earth" is reached. At one point Etidorhpa, with a train of other beautiful beings, comes before the pilgrim and asserts her sovereignty. The results of the author's reflections upon gravitation, matter, force, life, volcanoes, intemperance, and future life are incidentally introduced. The illustrations, by J. Augustus Knapp, deserve high praise. Prof. Lloyd has issued a limited edition of the book at a subscription price of $4.

Except a few pages occupied by administrative reports the fourth volume of the *Report of the Iowa Geological Survey* is devoted to descriptions of the geology of six counties —Allamakee, Linn, Van Buren, Keokuk, Mahaska, and Montgomery. The stratigraphy and economic products of each county are given with considerable fullness, and the physiography more briefly. There are good beds of coal in one or two of these counties and more or less building stone, brick clay, lime, etc., but so few deposits of metals as to afford little inducement for prospecting. The volume is handsomely printed and contains illustrations and county maps.

We have received a copy of the second edition of Prof. *Sadtler's Handbook of Industrial Organic Chemistry* (Lippincott, $5), the first edition of which we noticed in our January issue for 1892. "The fact that a large edition of the book has been exhausted in about three years and a half, and that it has been temporarily out of print, leads me to think," says the author, "that the plan of treatment adopted was an acceptable one, and that such a book was needed." In the present edition the bibliography has been rewritten and brought carefully up to date. While the body of the text has not been altered, numerous corrections have been made.

In the appendix two new tables are added, giving the physical and chemical constants of the oils, fats, and waxes classified for reference and comparison. This work contains so much valuable information of a character otherwise inaccessible to the general reader, even if he possess a good cyclopædia, that we have been much pleased at the opportunity of noticing a second edition.

Compressed Air, by *Frank Richards* (Wiley, $1.50), is a little treatise on air compression, and the transmission and application of compressed air. The main portion of the book consists of a series of articles which have appeared during the last few years in the columns of the American Machinist. They treat of the various practical details in the shape of machinery, methods of distribution, etc., which have had to be solved in the use of compressed air as a means of power distribution and application. There is an interesting chapter comparing compressed air with electricity, and another which discusses the numerous ways in which the former may be utilized.

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Fragments of Science.

Seven Years of Strikes.—Mr. Wright, the Commissioner of Labor, gives some interesting information in his last report. During the past seven years and a half the number of persons thrown out of employment by strikes was 2,391,203. His tabulation by States shows that the majority of these disturbances took place in five States—Illinois, Massachusetts, New York, Ohio, and Pennsylvania. These States contained fifty-one per cent of all the manufacturing establishments and employed fifty-six per cent of the capital invested in the mechanical industries of the country. Out of a total of 10,488 strikes for the entire country, more than fifty-six per cent occurred in twenty-six cities. The total wages loss in these twenty-six cities, Mr. Wright estimates, was in round numbers $35,000,000, and the loss to employers was something less than $29,000,000. Twenty-five per cent of these strikes were for an increase of wages, thirteen per cent were for reduction of hours, eight per cent were against reduction of wages, seven per cent were sympathetic, six per cent were for increase of wages and reduction of hours, four per cent were against the employment of non-union men, and three per cent for a recognition of the union. A study of the great effort and loss which these struggles present, says Architecture and Building, will compel the conclusion that some method of arbitration should be adopted.

The Nose as a Germ Filter.—It would seem, from the researches of St. Clair Thompson and R. T. Hewlett (London Lancet, January 11th), that the human nose is a nearly perfect filter for micro-organisms. These experimenters calculated that under very favorable conditions the lowest number of organisms contained in the inhaled air of an hour was fifteen hundred, and that oftentimes in the air of a great city there must be as many as twelve or fourteen thousand drawn into the nose during the same period of time. The fate of the thousands of microbes which thus enter the human body is a question of great pathological interest, and this increases when it is remembered that the expired air is practically free from germs. The fact that inspired organisms do not, as a rule, reach the air cells, was first pointed out by Lister. Later, Tyndall showed by his experiments with a ray of light in a dark chamber that expired air—or, more exactly, the last portion of an expiration—was optically pure—i. e., that respiration has freed it from the particles of suspended matter with which it was laden. Since then numerous experiments have been made by bacteriologists, which show expired air to be free from germs. Grancher has made many experiments with the expired air of phthisical patients, and has never found in it the tubercle bacillus or its spores. "Now, as the air is practically freed from all germs by the respiratory act, we have to consider where and how the thousands of organisms are arrested in the air passages. The experiments of Hildebrandt would tend to prove that the air is entirely freed from all germs before reaching the trachea. In verifying this we have examined the mucus from the trachea of all animals recently killed in the laboratory, and up to the present have found the mucus to be quite sterile. We therefore commenced with the nasal fossæ, and found that the mucous membrane of the healthy nose only exceptionally shows any micro-or-

ganisms whatsoever. The interior of the great majority of normal nasal cavities is perfectly aseptic. On the other hand, the vestibules of the nares, the *vibrissæ* lining them and all crusts found there, are generally swarming with bacteria. These two facts seem to demonstrate that the *vibrissæ* act as a filter, and that a large number of microbes meet their fate in the moist meshes of the hair which fringes the vestibule. Germs which have penetrated into the nose are rapidly ejected by the action of the ciliated epithelium." The nasal mucus is an unsuitable soil for the growth of organisms, and hence is an important factor in that it does not further their multiplication. A pure culture of the *Bacillus prodigiosus* was prepared, and a sterilized loopful deposited at a distinct point on the nasal septum well within the vestibule. Cultures were made from this spot every few moments for two hours, with the result of a continually diminishing growth in the culture medium, the sample taken at the end of two hours producing no growth whatsoever. The foregoing facts emphasize the importance of nose-breathing, and the great danger which arises from the habit of breathing through the mouth, and the resultant unfiltered stream of bacteria which is drawn through the pharynx into the trachea and bronchi.

Deteriorating Effects of Alcohol.—In the Fifth International Congress against the Abuse of Alcohol, held at Basel, Switzerland, in August, 1895, Prof Gauls, of Zurich, and Drs. Smith, of Marbach, and Fürer, of Heidelberg, read papers on the influence of alcohol on the cerebral substance and its deteriorating effects even in moderation on the memory and reasoning faculties. Drs. Smith and Fürer contended that intellectual work is always better during periods of abstinence than when strong drink is even sparingly indulged in. The reports presented by directors of lunatic asylums pointed to the conclusion that lunacy increases in direct proportion to the abuse of alcohol. On this point the preponderance of the sympathies of the meeting was evidently in favor of total abstinence. The influence of alcohol in fostering crime was dwelt upon by MM. Kohlinski, of Düsseldorf, and Marthaler, of Berne, penitentiary chaplains, and was made prominent by M. Denis, who endeavored by elaborate statistical returns to show the length to which European countries had gone in combating this source of criminality. France and Belgium, where no serious attempt has been made to restrain the spread of alcoholism, have, he said, the worst record in regard to crime. Switzerland and Holland, he contended, where the restrictive movement had already begun, had rendered crime "stationary," preluding a reduction in its prevalence as the movement became more energetic. Norway and Sweden, as already indicated, could boast of a distinct diminution in their criminal population, thanks to their control of alcoholism.

A Correction.—

Editor Popular Science Monthly:

Sir: On page 575 of your issue for August, 1895, is the statement, "Prof. Simon Newcomb has been elected by the French Academy of Sciences an associate academician as successor to the late Prof. Helmholtz." As this fact is apparently ignored in the article on page 561 of the February issue (1896), where it says, "As yet the name of no citizen of the United States has been inscribed on the roll of the foreign associates of the institute, although it is understood that in a recent election to fill the vacancy occasioned by the death of a member the name of Prof. Simon Newcomb, of Washington, lacked but a few votes of receiving this honor," it is perhaps well to say that the former item is the correct one, and that Prof. Newcomb was elected a foreign associate of the French Academy of Sciences on June 17, 1895. Very truly yours,

Marcus Benjamin.

Washington, D. C., *February* 25, 1896.

Prof. Röntgen's X Rays.—The recent experiments of Prof. Röntgen on the so-called cathode rays from a Crookes, Lenard, or Hittorf vacuum tube, described by him in the Sitzungsberichte der Würzburger physikalische-medicinische Gesellschaft, 1895, and translated for Nature, are really only a continuation of the work of Hertz and Lenard, who experimented with these rays several years ago, and determined their curious property of passing through substances opaque to the ordinary light rays, and the

latter of whom obtained photographic images quite similar to those of Prof. Röntgen. The rays with which the latter works, and which he calls the X rays, are chiefly seated at the place of most brilliant phosphorescence on the walls of the discharge tube; "that is, the X rays proceed from the front where the cathode rays strike the glass. If one deviates the cathode rays within the tube by means of a magnet, it is seen that the X rays proceed from a new point—i. e., again from the end of the cathode rays." The X rays, Prof. Röntgen says, differ from the cathode rays in two important particulars. Air absorbs the X rays much less than it does the cathode rays; and while the cathode rays are sharply deflected by a magnet, the X rays are apparently not at all affected by a magnet. The X rays could not be deflected by the use of ordinary prisms, but with prisms of ebonite and aluminum images were obtained on a photographic plate which point to a possible deviation. Lenses apparently have no effect in concentrating the X rays. The transparency of a great number of substances to these X rays, such as ebonite, glass, wood, cardboard, platinum, and many others, was tested, as also the effect of the thickness of the substance, and led to the conclusion that the density of the bodies is the property whose variation mainly affects their permeability, but that this alone does not determine the transparency. Increasing thickness increases the hindrance offered to the rays by all bodies. "The justification for the term 'rays' applied to the phenomena lies partly in the regular shadow pictures produced by the interposition of a more or less permeable body between the source and a photographic plate or fluorescent screen." The rays have the property of producing fluorescence in various substances, as barium platino-cyanide, calcium sulphide, uranium glass, Iceland spar, rock salt, etc., as well as of acting on a dry plate. "The retina of the eye is quite insensitive to these rays." Prof. Röntgen says in reference to their refraction: "Since I have found no evidence of refraction at the surface of different media, it seems probable that the X rays move with the same velocity in all bodies; and in a medium which penetrates everything and in which the molecules of bodies are imbedded. . . . It is known that Lenard, in his investigations on cathode rays, has shown that they belong to the ether, and can pass through all bodies. Concerning the X rays, the same may be said." Prof. Röntgen closes his paper with the following paragraphs: "A kind of relationship between the new rays and light rays appears to exist; at least, the formation of shadows, fluorescence, and the production of chemical action point in this direction. Now it has been known for a long time that besides the transverse vibrations which account for the phenomena of light, it is possible that longitudinal vibrations should exist in the ether, and according to the view of some physicists must exist. It is granted that their existence has not yet been made clear, and their properties are not experimentally demonstrated. Should not the new rays be ascribed to longitudinal rays in the ether? I must confess that I have in the course of this research made myself more and more familiar with this thought, and venture to put the opinion forward, while I am quite conscious that the hypothesis advanced still requires a more solid foundation." The most striking of the pictures accompanying the article are the photograph of a compass card and needle completely inclosed in a metal case, and a cut of the human hand showing quite beautifully the bones and joints.

The Incubator Bird (Megapodius Tumuli).—An account in the Geographical Journal of a trip to the little island of Niuafou, in the South Pacific, describes a native bird called the *malau*, which is apparently of the same order as the *Megapodes;* it makes no nests, but buries its eggs in the soft, hot sand of this volcanic island. It is about the size of a small domestic fowl. Its eggs are large and of a dull reddish color. The strange nesting habit and the large size of its eggs recall that curious bird the jungle fowl of Australia (*Megapodius tumulus*). Great numbers of high and large mounds exist in some parts of Australia, which were for a long time thought to be the tombs of departed natives; the natives, however, disclaimed the sepulchral character, saying that they were artificial ovens in which the eggs of the jungle fowl were laid, and which, by the heat that is always disen-

gaged from decaying vegetable substances, preserved sufficient warmth to hatch the eggs. The size of some of these mounds is quite marvelous. One which was measured proved to be fifteen feet high and sixty feet in circumference. The whole of this enormous mass was made by the jungle fowl. If the hand be inserted into the interior of the heap it will always be found quite hot. In almost every case the mound is placed under the shelter of densely leaved trees. This precaution is probably taken to prevent the rays of the sun from evaporating the moisture. The bird seems to deposit its eggs by digging holes from the top of the mound, laying the egg at the bottom, and then making its way out again, throwing back the earth it had scooped away. The holes are not dug perpendicularly, so that although they are six or seven feet in length they may be only two or three feet from the surface. The *leipoa*, or native pheasant of Australia, like the preceding, lays its eggs in a mound of earth and leaves, but the mound is not nearly so large. Another bird having this curious nesting habit is the brush turkey of New South Wales. In the Guide to the Gardens of the Zoölogical Society of London an interesting account of the construction of the mound by some captive birds is to be found. "On being removed into an inclosure with an abundance of vegetable material within reach, the male begins to throw it up into a heap behind him by a scratching kind of motion of his powerful feet, which projects each footful as he grasps it for a considerable distance in the rear. As he always begins to work at the outer margin of the inclosure, the material is thrown inward in concentric circles until sufficiently near the spot selected for the mound to be jerked upon it. As soon as the mound is risen to a height of about four feet, both birds work in reducing it to an even surface, and then begin to excavate a depression in the center. In this in due time the eggs are deposited as they are laid and arranged in a circle about fifteen inches below the summit of the mound at regular intervals with the smaller end of the egg pointing downward. The male bird watches the temperature of the mound very carefully; the eggs are generally covered, a cylindrical opening being always maintained in the center of the circle for the purpose of giving air to them, and probably to prevent the danger of a sudden increase of heat from the action of the sun or accelerated fermentation in the mound itself. In hot days the eggs are nearly uncovered two or three times between morning and evening. On the young bird chipping out of the egg it remains in the mound for at least twelve hours without making any effort to emerge from it, being at that time almost as deeply covered up by the male as the rest of the eggs. On the second day it comes out. Early in the afternoon it retires to the mound again and is partially covered up for the night by the assiduous father. On the third day the nestling is capable of strong flight."

Indiana Academy of Science.—The eleventh annual meeting of the Indiana Academy of Science was held in the State House at Indianapolis December 27th and 28th. The meeting was one of the best ever held. Over forty new members were elected. The address by the retiring president, Mr. A. W. Butler, on Indiana: A Century of Changes in the Aspects of Nature, was intensely interesting and very profitable. A poem by Mr. W. W. Pfrimmer, the "Kankakee poet," on The Naturalist, was a novel yet a pleasing feature. Many of the papers were worthy of special mention if space permitted. The Recent Earthquakes East of the Rocky Mountains, by A. H. Purdue, and Unconscious Mental Cerebration, by C. E. Newlin, were perhaps two of the most interesting. The report of the Biological Survey on Turkey Lake deservedly attracted much attention. The spring meeting will probably be held in joint session with the Ohio Academy near the State line. Officers for next year are as follows: President, Stanley Coulter, Purdue University; Vice-President, Thomas Gray-Rose, Polytechnic; Secretary, John S. Wright, Indianapolis; Assistant Secretary, A. J. Bigney, Moore's Hill College; Treasurer, W. P. Shannon, Greensburg.

A. J. BIGNEY,
Assistant Secretary.

Dirt-Eating.—The habit of dirt-eating among children is the subject of an interesting paper by Dr. John Thomson. He finds that it occurs in two classes of chil-

dren: (1) In cases of ill health from tuberculosis, etc., anæmia being almost always a prominent symptom; and (2) in healthy children, the habit being formed in infancy and disappearing spontaneously when the children are about three years old. Dr. Thomson regards the habit in this latter class as analogous to thumb-sucking, perpetual rocking to and fro, or constant rolling in bed, in which some children find delight and which they lose when they pass out of infancy. The materials selected are chiefly wall plaster and cinders. One child varies the latter by pushing the hearth brush into the ashes and then licking the dust off as a great delicacy. The habit, as is well known, is common among imbeciles and idiots; but Dr. Thomson's cases were free from mental disorder. Dirt-eating may lead to serious consequences when the material eaten contains harmful matter. The native Egyptians, who, observing the marvelous fertilizing power of Nile mud, imagine it must be equally nutritious for men, habitually eat it, with the result of infecting themselves with the ova of anchylostoma, bilharzia, and other parasites.

Piano Touch.—When a certain point of perfection has been attained in piano-playing it becomes very hard to distinguish inequality of touch; yet, owing to the varying strength of the fingers, it is only with much practice that perfect equality is possible. An account of an apparatus for graphically registering these inequalities is given in a recent issue of Nature. The instrument was devised and used for experimental work by MM. Binet and Courtier. It is said to be simple in construction and very accurate. The advantages claimed for the instrument are threefold: (1) It is found that the voluntary movements of the pianist can be observed without putting him to any restraint or embarrassment, for the resistance of the keys is not affected nor is the exterior of the piano altered; (2) for teaching purposes the device has been found of great use; the record made on a roll of paper shows the faults so precisely that, although they are scarcely perceptible to the ear, there is no denying their existence; (3) written music can not show every slight change in time the composer might desire, but by applying the graphical method this difficulty is eliminated and the time will be reproduced with the smallest details.

The Cigar-Case Bearer.—A new fruit-tree pest has recently appeared in New York State, and is described in a bulletin from the Cornell Experiment Station. It is called the cigar-case bearer. Owing to its small size and peculiar habits, the insect in any stage will be rarely noticed by a fruit-grower, and yet the second one of the curious suits or cases which the little caterpillar wears is conspicuous enough to reveal its presence to the casual observer. The first suit is manufactured in the fall, to be worn all winter; but about the 15th of May the half-grown caterpillar finds this too small, and proceeds to make a summer suit which resembles a miniature cigar in shape and color. The first indication of the insect's presence occurs on the swelling buds of apple, pear, or plum trees. The work on the expanded foliage is seen in skeletonized dead areas, which have near their centers a clean-cut round hole through one skin, usually on the under side of the leaf. The caterpillars also often attack the growing fruit. It is only possible to fight the insect successfully in the caterpillar stage, and even then it requires very thorough work to destroy it.

A Contemplated Antarctic Expedition.—A committee has been formed in London to promote a mercantile and scientific antarctic expedition, and has already published its plan of operations. The scientific contingent, which will be accompanied by Mr. C. E. Borgrevink, will consist of twelve Englishmen trained in science, equipped with the necessary huts, dogs, sledges, etc., and will be left at Cape Adare, with the expectation of spending one year in South Victoria Land. The investigations will include the work of a land party toward the south magnetic pole, there to make magnetic observations; a survey of the coast line of the open bay, with exploration and soundings of fiords and bays; the making of zoölogical, botanical, mineralogical, and geological collections; dredging; and barometrical, thermometrical, meteorological, pendulum, air-current, and water-current observations. While the scientific men are thus exploring the land, the vessels

will hunt whales, seals, etc., and expect to make three trips with their cargoes between the antarctic country and Melbourne. It is contemplated now that the expedition shall start about the 1st of September. Some money has been subscribed for the cost, but more is needed.

Mountain-climbing in Montana. — An article describing a trip of exploration to the Montana Rockies by L. W. Chaney, Jr., in a recent issue of Science, contains some interesting facts. In July last the party entered the mountains by the Great Northern road, which crosses the range about forty miles south of the international boundary, following on the western side of the divide the Middle Fork of the Flathead River. Twenty miles from the summit, at Two-Medicine Pass, is Belton Station. Here there falls into the fork a large and rapid mountain creek; it comes from Macdonald Lake, three miles away in the mountains to the northward. This lake is already much resorted to for fishing and camping purposes. At the northern end of it a small settlement exists, and from here the party started. After some unproductive explorations in a neighboring valley, they decided to try their fortunes farther north, and set out for a group of mines known as the International Camp, where the range, after sweeping northward from Lake Macdonald for thirty miles, turns quite abruptly to the west. This camp is sixty-five hundred feet above the sea. To the east is a saddle of the main range some two thousand feet above the camp. "To this saddle we then directed our attention, and the morning after our arrival we made the ascent, finding it not difficult. Immediately on stepping down from the rocks on the eastern side of the range we found an immense snowfield filling an amphitheater some four miles in diameter. As we crossed the snowfield to the east there appeared running parallel with the curving wall of the amphitheater lines upon the surface, whose significance we did not at first apprehend. Observations with the field glass soon indicated, what closer examination afterward confirmed, that these were long crevasses in the ice. We then knew that we stood upon the upper snowfields of a glacier not of great size, but in many respects very typical. Passing on to the eastern side of the amphitheater we ascended the rocky ridge which formed its boundary. Then suddenly there burst upon us one of the most tremendous mountain scenes any of the party had ever had the good fortune to witness. Sheer down below was a cliff which repeated experiments with falling rocks showed to be more than sixteen hundred feet of perpendicular precipice. From the base of this cliff the talus sloped down sharply to the bottom of the valley, no less than three thousand feet below. Around the northern end of the ridge on which we stood swept the glacier narrowed into a true ice river. As it broke over the cliff to plunge into the valley it was fractured with numerous crevasses. The largest was about twenty feet across, and into it plunged one of the surface streams which came down the glacier. Below in the valley lay a succession of lakes—the first of so deep and dark a blue that without hesitation we called it Emerald Lake. The moraine at the foot of the glacier was evidently almost entirely ground moraine. There were very few large rocks lying in a mass of finely divided gray detritus. Across this rushed the stream which came from the glacier." Some crude observations were made as to the rate of movement of the glacier; between two days there seemed to be a movement at the center of the mass of about two inches. Mr. Chaney commends these regions to those who wish to study mountain forms or glaciers and glaciation. "There is an abundant and very interesting fauna and flora, and on every side the majesty and glory of one of the noblest mountain ranges."

Commercial Liquid Air.—A method for the commercial preparation of liquid air has been devised by Herr Linde, and steps are being taken to put it into practical operation. The successive coolings to the critical temperature, which the chemists effect by the evaporation of other liquefied gases, are in this process brought about by successive compressions and expansions of gaseous air. With an adaptation of piston machinery a volume of air is [illegible]

when another and greater cooling takes place, and is communicated by an ingenious adjustment of the machinery to the air that is to be liquefied. The process is repeated, a lower temperature being reached at each repetition, till liquefaction is accomplished, and after this "a continuous stream of liquid air is merely a question of engine power." Further than this, the air during the process becomes steadily richer in oxygen, until that gas forms about seventy per cent of the product, pure enough for most of the purposes for which oxygen is used; and we have here a new source for the cheap supply of it.

The Scientific Alliance.—The Scientific Alliance of New York—which includes the resident active members of the New York Academy of Sciences, the Torrey Botanical Club, the Linnæan Society of New York, the New York Mineralogical Club, the American Mathematical Society, the New York Section of the American Chemical Society, and the New York Entomological Society—has nine hundred and thirty-nine members. An act of incorporation, formally accepted by all the societies, has been obtained from the Legislature of New York. Bulletins are issued about the 1st of each month from October to May, and announce most of the stated papers read before the societies. The list of the last year's papers includes upward of one hundred and eighty titles. A building committee has been appointed, but is at present awaiting the action of the trustees of the Tilden Trust upon a proposition made to them in 1892. Verbal assurances have been received from individual trustees that their plan of building contemplates giving the societies ample and very satisfactory accommodations in the building of the New York Public Library.

A New Variable Star.—The period of Wells's new variable star of the Algol type, known as B. D. + 17° 4367, has been ascertained at Harvard College Observatory to within a few seconds, and will probably be known within one second as soon as the form of light curve is determined. For nearly two hours before and after the minimum it is fainter than the twelfth magnitude. It increases at first very rapidly and then more slowly, and attains its full brightness, magnitude 9·5, about five hours after the minimum. Its variations may be explained by assuming that the star revolves around a comparatively dark body, and is totally eclipsed by it for two or three hours, the light at minimum, if any, being that of the dark body—a condition resembling those of U. Cephei. The variation in light of the new star is greater than that of any other star hitherto discovered.

A New Library Pest.—A comparatively recent importation, which is described in Insect Life, is the *Nicobium* (*Anobium*) *hirtum* III of the coleopterous family *Ptinidæ*. It is a native of southern Europe, but has been occasionally found in American libraries for a number of years. It seems now, however, to have become quite abundant, and is doing considerable damage in some of the older libraries of the Southern States. The larva of *Nicobium hirtum* does not differ in general appearance from other ptinid larvæ—i. e., it closely resembles a white grub in miniature, in shape and characteristic curvature of the body. It is covered with sparse but rather long hairs, while even a feeble magnifying glass will show numerous short, brownish spines, with which the larger portion of the dorsal surface is furnished. Although the legs are well developed, the larvæ are barely able to make use of them, and if shaken from the books they are unable to climb back to the shelves. They attack especially old books with soft paper and paper bindings. The beetle is of elongate, oval, cylindrical form, 0·12 to 0·16 inch in length, its color rather light brown, but rendered grayish by a dense, short, and somewhat velvety pubescence. This pubescence, however, does not uniformly cover the elytra, but is here absent on two or three transverse bands of which the anterior is usually quite distinct, while the two posterior ones are less clearly marked out and often confluent or broken up into spots. This peculiar arrangement of the pubescence, as well as the strongly punctate elytral striæ, render this species at once distinguishable from all other beetles which are liable to occur in the rooms of a library.

MINOR PARAGRAPHS.

WHILE illustrating glacier movements to the British Association, Prof. W. J. Sollers said that pitch and glacier ice strikingly resemble each other in behaving as solids or liquids, according to circumstances. On the sudden application of force they are very brittle, but behave as fluids when subjected to gradual pull and pressure. Hence it is possible to employ pitch in the construction of working models of glaciers, in order to get an insight into those internal movements of real glaciers which are beyond the reach of actual observation. The study of glacial deposits has shown that many erratic bowlders are transported during the Glacial period from lower to higher levels hundreds of feet and left stranded on the rocky flanks of mountains. This standing difficulty in the way of physical theories of glacial movement has been explained by the study of pitch models, by means of which it is found that the lower layers of material, in approaching an obstacle, are carried up in an ascending current. The inference, which is confirmed by natural facts, is that similar movements would certainly take place in actual glaciers. Further, a glacier sometimes overrides its terminal without disturbing it, and in an experiment performed by the author this was exemplified, for pitch flowed for several months over a ridge of loose material without carrying a particle of it away.

BELIEVING that the longest-tongued bees are the most profitable—they being able to extract honey from the greatest depths within the flowers yielding it—MM. Charton and Legros have devised methods for measuring bees' tongues. M. Charton's apparatus consists of a box covered with metallic netting, and having the bottom slightly inclined. On this bottom is spread a sweetened liquid which the bees can reach only by passing their tongues through the meshes of the netting. The hive whose bees can suck farthest down the inclined bottom is preserved as a stock for reproduction. M. Legros uses a receiver closed by a sheet of perforated tin plate, from which the sweetened liquid is fixed at carefully adjusted distances. M. Legros finds that the tongues of common unselected bees are 6·5 millimetres long, while the black French bees can extract sirup at a maximum distance of 9·2 millimetres. The tongues of the best American bees reach to 8·73 millimetres.

THE domestic weeds of ancient civilization, the roadside weeds and the cornfield weeds, says W. B. Hemsley, in a recent issue of Knowledge, have accompanied man in his most distant wanderings, and in many instances have developed increased vigor, and a power of colonization unsurpassed by man himself. In some instances the reproduction and spread of these weeds are so rapid as to become a great scourge to agriculture, overrunning and destroying crops almost as effectually as swarms of locusts, and laws have been framed making it compulsory on farmers to keep their land free of these prolific strangers. During the last three or four years the so-called Russian thistle (*Salsola kali*, var. *tragus*) has been occupying the serious attention of the farmers of the Eastern and Central States of North America. Thousands of square miles are infested, and the loss resulting therefrom in 1892 was estimated to exceed two million dollars.

PROF. JOHN MILN'S report of eight thousand three hundred and thirty-one earthquake shocks recorded in Japan, in which the position of the origin of each shock and the extent of country disturbed by it are described, deals further with the propagation of earthquake disturbances on the surface of the earth, and possibly through it. Elastic gravitational waves travel in Japan, or thence to Europe, as surface waves at a rate of three thousand metres per second, increasing in period as they proceed; these are the earthquake disturbances proper. Preceding them in Japan are minute vibrations, and these apparently travel to Europe at a rate of from about eight thousand to ten thousand metres per second. It is suggested that they may travel, not along the surface, but through the mass of the earth, by some path, straight or curved; and that with a speed greater than would be expected if the globe were of glass or steel. Dr. Rebeur Paschnitz is of the opinion that if such be the case they may throw light on the internal structure of the globe.

NOTES.

At Bedford College (for women) in England a very commendable addition to the curriculum has recently been made in the establishing of a special course in hygiene. Students are required to devote themselves for one session at least to physiology, bacteriology, chemistry, and physics, practically as well as theoretically. It is ordinarily taught in a disconnected, half-hearted way, and has had to give way to subjects of much less importance. It is to be hoped that institutions in this country will take example from Bedford College.

In an article in the Chemical News on the places of argon and helium among the elements, R. M. Deeley says: The discovery of these two elements having small atomic weights has undoubtedly had the effect of greatly shaking the confidence of chemists in the periodic classification of the elements. Indeed, a disposition is often shown to place the periodic law altogether in the background and put undue faith in physical evidence, which is admitted to be inconclusive. The facts are then reviewed from the standpoint of the periodic law, and the difficulties of placing these new elements clearly shown. He closed his paper with the following paragraph: "Under such circumstances would it not be well to follow the indications of the periodic law and refraction equivalents, rather than a doubtful theory concerning the dynamics of the molecule?"

Three years ago M. Joseph F. Loubat, of Paris, offered prizes of one thousand dollars and four hundred dollars, to be awarded every fifth year to authors of the best works on the history, geography, archæology, ethnology, philology, or numismatics of North America within the period mentioned. A committee composed of Prof. H. T. Peck, of Columbia College; Dr. D. G. Brinton, of the University of Pennsylvania; and Prof. Henry C. Adams, the latter of whom was awarded the prize in 1893, will adjudicate essays and works for the next award in 1898.

The defect in ordinary photographing under which the colors fail to be rendered in their proper proportions of black and white is corrected in Mr. Bothamley's orthochromatic photography, by the use of minute quantities of certain dyes, which make the plate more sensitive to orange, yellow, and green rays. By this means colored objects of all kinds, including landscapes, are rendered in monochrome much more correctly.

Prof. Bailey, of the Harvard Observatory station at Arequipa, Peru, has discovered from an examination of the photographs obtained by him of certain globular star-clusters that they contain an extraordinary number of variable stars. This does not appear, however, to be a general condition of stellar clusters. In the cluster in Canes Venatici, Messier 3, eighty-seven stars have been proved to be variable. Sometimes the variation amounts to two magnitudes or more, and sometimes it does not appear to exceed half a magnitude. Forty-six variables were found in Messier 5. Some of these variables have short periods, not more than a few hours. All the cases included in these counts were confirmed by the independent examinations of the photographs by three persons. Other instances of variation were noticed, but are not included, because they have not been sufficiently tested.

Michael S. Bebb, a specialist in the botany of the willow, died in San Bernardino, Cal., December 5th. He was a son of Governor William Bebb, of Ohio, and was born at Hamilton, in that State, in 1833. He began his botanical studies when a boy, led to them probably by the flowers and shrubs in his father's garden, and using Torrey's Report upon the Flora of New York as his only guide and text-book. His family afterward removed to Illinois. Some years after the close of the war he began the systematic study of the willows, and made his first communication on them to the American Naturalist in 1874. He studied all the collections of these plants made in North America; described the California species in Brewer and Watson's Botany of California; the Southwestern species collected by Rothrock, in Wheeler's Report; the Colorado species in Coulter's Manual of the Botany of the Rocky Mountain Region; the species of the Eastern States in the last edition of Gray's Manual; determined the willows of British America for the Geological Survey of Canada; and has contributed to botanical journals many papers on American species of the genus.

Prof. George Lawson, of the chair of Chemistry in Dalhousie College, Halifax, N. S., who died in that city November 10th, was author of several papers on Canadian plants, published mostly in the Transactions of the Royal Society of Canada, and was an authority on the botany of the Maritime Provinces.

Dr. Francis Payne Poucher, a distinguished physician and botanist, died at Charleston, S. C., where he was Professor of Materia Medica and Therapeutics in the Medical College, November 19, 1895, aged about seventy years. He was editor of the Charleston Medical Journal and Review, and author of books on the Southern Fields and Forests; a Medico-botanical Catalogue of the Plants and Ferns of St. John's, Berkeley, S. C.; A Sketch of the Medical Botany of South Carolina; and the Medicinal, Poisonous, and Dietetic Properties of the Cryptogamic Plants of the United States.

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***

Stephen Crane, author of *The Red Badge of Courage*, was born in Newark, N. J., and was a student at Lafayette College. The first Stephen Crane came from England to Massachusetts in 1635, and the family has included several clergymen and soldiers. Mr. Crane's first writing was newspaper hack work done at the age of sixteen. Later he wrote some sketches for the New York *Tribune* and other papers. He became interested in the study of low life in New York, and at the age of twenty-one he wrote *Maggie: A Girl of the Street*, which was put into type and copyrighted, but never published. In December, 1894, Mr. Crane called upon Messrs. D. Appleton & Co. with two short stories as examples of his literary work. Their merit was recognized and he was asked if he had no story long enough for publication in book form. This inquiry brought out *The Red Badge of Courage*, which was then being published by a newspaper syndicate. *The Red Badge of Courage* was read, accepted, and published in the autumn of 1895. Its remarkable power and originality attracted attention. In England the book was published by Mr. William Heinemann,

who was prompt to recognize the quality of Mr. Crane's work, and English critics joined in an almost unanimous chorus of eulogy. It must be remembered that the book was written when Mr. Crane was only twenty-two. He had seen nothing of war. His talks with old soldiers had yielded him little or nothing, because the old soldier is rarely able to recall details and analyze impressions and emotions. Out of his own imagination Mr. Crane evolved the feelings of the raw recruit in his first battle, and yet the vivid realism of his results impresses itself upon every reader. The *Atlantic Monthly* has said that "the original power of *The Red Badge of Courage* is great enough to set a new fashion in literature," and other American reviewers have bestowed no less exceptional praise upon this young author, while in England experienced critics have ranked *The Red Badge of Courage* even above the work of Tolstoy and Zola. For some years there has been no literary success in this country so prompt and so striking. It is pleasant to recall the fact that the author who stands at the head of living American novelists, Mr. W. D. Howells, was probably the first to recognize the promise of Mr. Crane's work, and his kindly and helpful interest has been unflagging from the outset.

Of other work by Mr. Crane we need note only a volume of poems, and a series or two of syndicate letters, the results of travels in the South and Mexico for Mr. Irving Bacheller. The date of his next book is not fixed upon definitely, but he has been rewriting his story of *Maggie*, which will be given to the public perhaps in the early summer, and there will also be a volume dealing with war experiences, complementary, as it were, to *The Red Badge of Courage*, which is now in its fourth edition.

* * *

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* * *

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***

In the opinion of many observers there are signs of an increased interest in American literature, and the success of American fiction like *The Red Badge of Courage*, now in its fourth edition, and of *In Defiance of the King*, by Mr. C. C. Hotchkiss, has been taken as an illustration of a coming reaction toward the American novel. It is for readers rather than reviewers, however, to prove or disprove this theory. It is safe to say that the abundant favor shown to the two books which have been cited will be shared by Mrs. K. M. C. Meredith's new novel *Green Gates*, a brilliant study of social life in New York and in a Long Island country house, and also by the fascinating romance of post-Revolutionary days, by Anna Robeson Brown, entitled *Sir Mark*, a tale of the first capital. This historical romance has England for its scene in its first pages, and the latter half describes Philadelphia when Washington was President.

***

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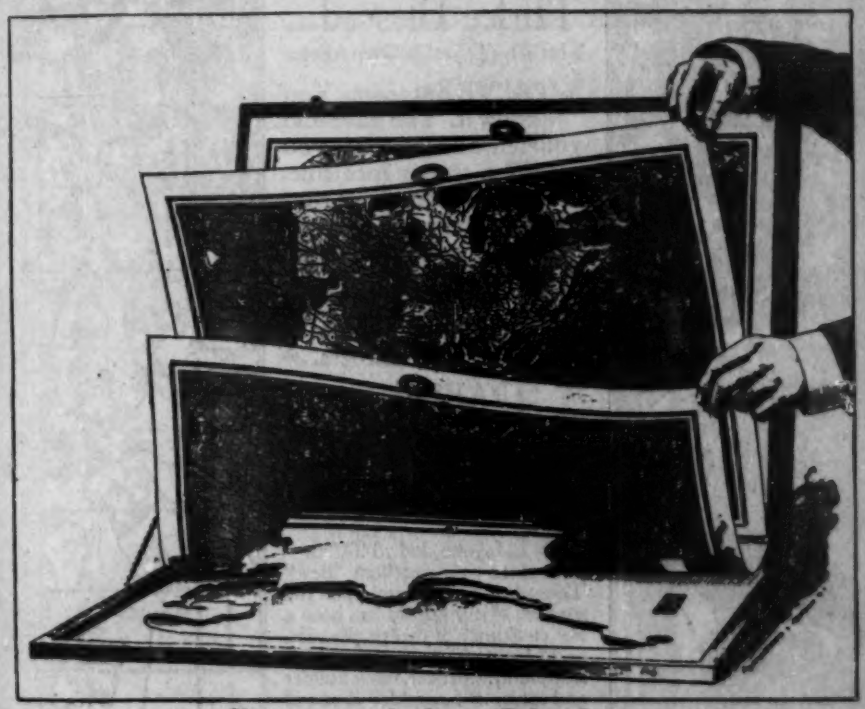

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APRIL, 1896.

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Interest accrued but not due	190,872.95
Loans on collateral security	1,466,922.42
Deferred Life Premiums	979,801.98
Premiums due and unreported on Life Policies	365,741.93
State, county, and municipal bonds	3,317,837.19
Railroad stocks and bonds	3,289,302.75
Bank stocks	1,073,414.00
Miscellaneous stocks and bonds	1,397,718.10
Total Assets	$19,425,230.34

LIABILITIES.

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Reserve for Re-insurance, Accident Department	1,861,880.84
Present value of Matured Installment Policies	880,880.00
Special Reserve for Contingent Liabilities	435,544.00
Losses unadjusted and not due, and all other Liabilities	294,897.00
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Surplus to Policy-holders	$2,661,245.70

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Returned to Policy-holders in 1895	$ 1,002,390.78
Returned to Policy-holders since 1864	19,696,697.93

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Number of Accident Policies written	8,219,696
Number of Accident Claims paid in 1895	13,564
Whole number of Accident Claims paid	275,819
Returned to Policy-holders in 1895	$ 1,942,987.34
Returned to Policy-holders since 1864	13,454,252.66
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